IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

PARKER-HANNIFIN CORPORATION, and PARKER INTANGIBLES, LLC Plaintiff, v. ZIPPERTUBING (JAPAN), LTD., Defendant.	Civil Action No. 06-751-JJF

DECLARATION OF WILLIAM J. MARSDEN, JR.
RE ZIPPERTUBING'S OPENING CLAIM CONSTRUCTION BRIEF

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Date: July 1, 2008

WILLIAM J. MARSDEN, JR. declares:

1. I am a member of the bar of the State of Delaware and have been admitted to practice by this court. I have personal knowledge of the facts stated herein and would testify to them under oath if called upon to do so.

2. I am an attorney in the law firm of Fish & Richardson, P.C, counsel for Defendant, Zippertubing (Japan) Ltd. ("Zippertubing") in this matter.

3. I make this declaration to identify documents submitted with Zippertubing's Opening Claims Construction Brief.

4. Exhibit A is a true and correct copy of U.S. Patent No. 6,521,348.

5. Exhibit B is a true and correct copy of U.S. Patent No. 6,716,536.

6. Exhibit C is a true and correct copy of U.S. Patent No. 6,777,095.

7. Exhibit D is a true and correct copy an email sent on May 9, 2008 by Steven Nash, Esq., counsel for Plaintiffs, Parker Hannifin Corp., et al., to Zippertubing's counsel.

8. Exhibit E is a true and correct copy of "Guidelines for Patent Claim Construction" prepared by the Patent Litigation Committee of the Federal Circuit Bar Association.

9. Exhibit F is a true and correct copy of an Office Action dated August 9, 2002, taken from the prosecution history of U.S. Patent No. 6,521,348.

10. Exhibit G is a true and correct copy of an Amendment and Response dated November 13, 2002, taken from the prosecution history of U.S. Patent No. 6,521,348.

11. Exhibit H is a true and correct copy of an Office Action dated October 3, 2001, taken from the prosecution history of U.S. Patent No. 6,387,523.

12. Exhibit I is a true and correct copy of an Amendment and Response dated January 4, 2002, taken from the prosecution history of U.S. Patent No. 6,387,523.

13. Exhibit J is a true and accurate copy of a Preliminary Amendment dated March 10, 2004, taken from the prosecution history of U.S. Patent No. 6,777,095.

14. I declare under the penalty of perjury that the foregoing is true and correct.

July 1, 2008

/s/ William J. Marsden, Jr.
William J. Marsden, Jr.

CERTIFICATE OF SERVICE

I hereby certify that on July 1, 2008, I electronically filed with the Clerk of Court this **DECLARATION OF WILLIAM J. MARSDEN, JR. RE OPENING CLAIM CONSTRUCTION BRIEF OF DEFENDANT ZIPPERTUBING (JAPAN), LTD.** using CM/ECF which will send electronic notification of such filing(s) to the following Delaware counsel. In addition, the document was caused to be served on the attorneys of record, at the following addresses and in the manner indicated::

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EXHIBIT A

US006521348B2

(12) **United States Patent**
Bunyan et al.

(10) **Patent No.: US 6,521,348 B2**
(45) **Date of Patent: *Feb. 18, 2003**

(54) **FLAME RETARDANT EMI SHIELDING GASKET**

(75) Inventors: **Michael H. Bunyan**, Chelmsford, MA (US); **William I. Flanders**, Merimack, NH (US)

(73) Assignee: **Parker-Hannifin Corp.**, Cleveland, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/142,803**

(22) Filed: **May 9, 2002**

(65) **Prior Publication Data**

US 2002/0125026 A1 Sep. 12, 2002

Related U.S. Application Data

(63) Continuation of application No. 09/883,785, filed on Jun. 18, 2001, now Pat. No. 6,387,523, which is a continuation of application No. 09/250,338, filed on Feb. 16, 1999, now Pat. No. 6,428,393.

(60) Provisional application No. 60/076,370, filed on Feb. 27, 1998.

(51) **Int. Cl.**[7] **B32B 5/14**; B32B 5/18; H05K 9/00

(52) **U.S. Cl.** **428/457**; 361/818

(58) **Field of Search** 427/77; 361/818; 428/457

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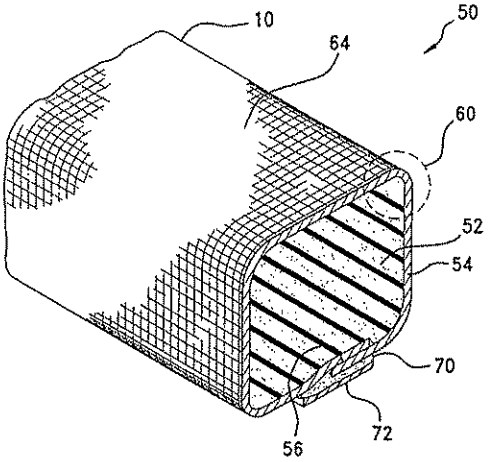
(List continued on next page.)

Primary Examiner—Erma Cameron
(74) *Attorney, Agent, or Firm*—John A. Molnar, Jr.

(57) **ABSTRACT**

A flame retardant, electromagnetic interference (EMI) shielding gasket construction. The construction includes a resilient core member formed of a foamed elastomeric material, an electrically-conductive fabric member surrounding the outer surface of the core member, and a flame retardant layer coating at least a portion of the interior surface of the fabric member. The flame retardant layer is effective to afford the gasket construction with a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

18 Claims, 3 Drawing Sheets



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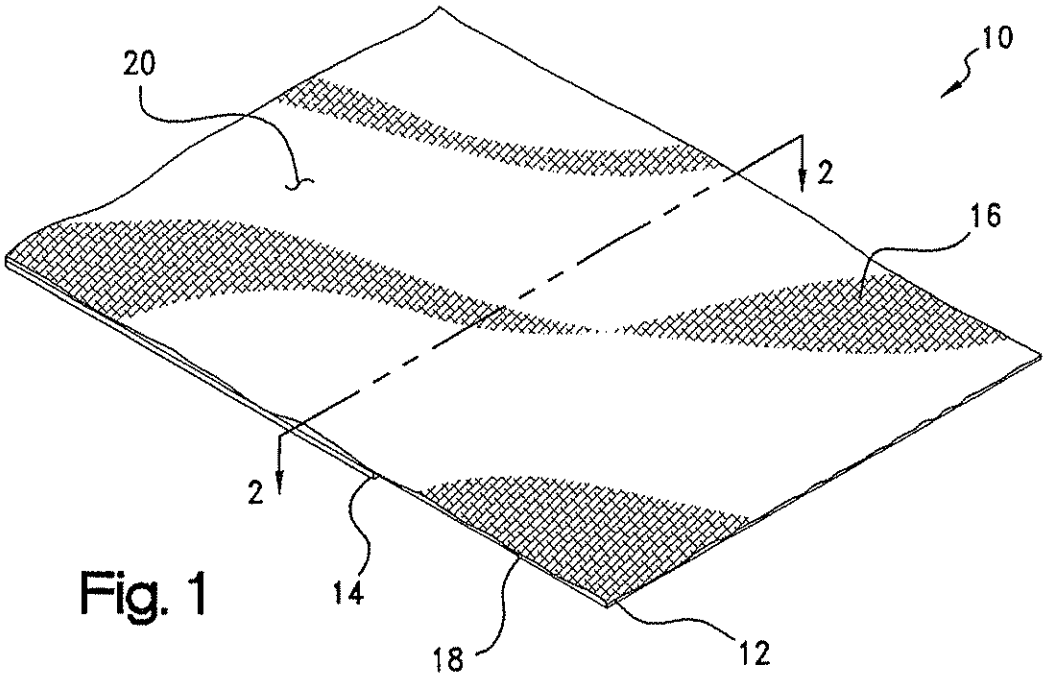

Fig. 1

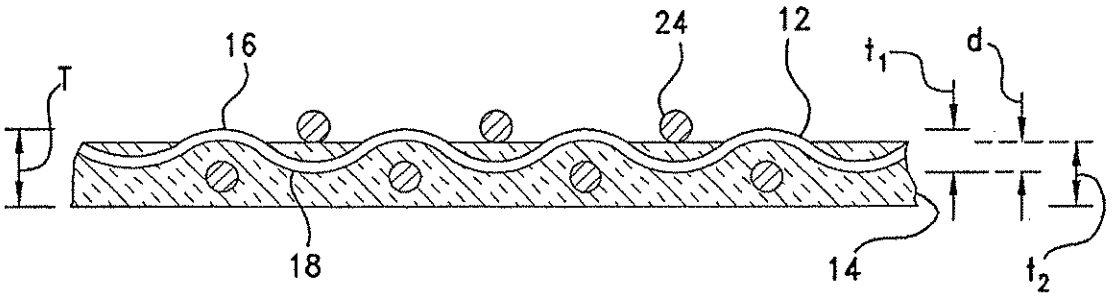

Fig. 2

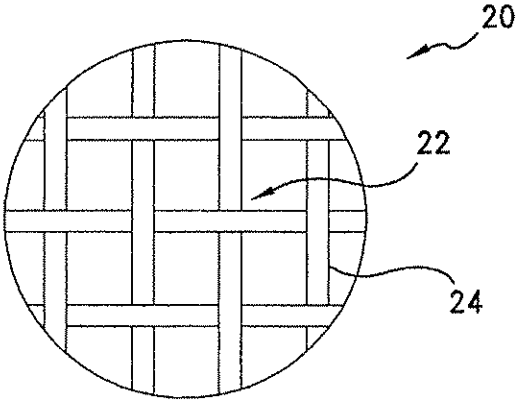

Fig. 3

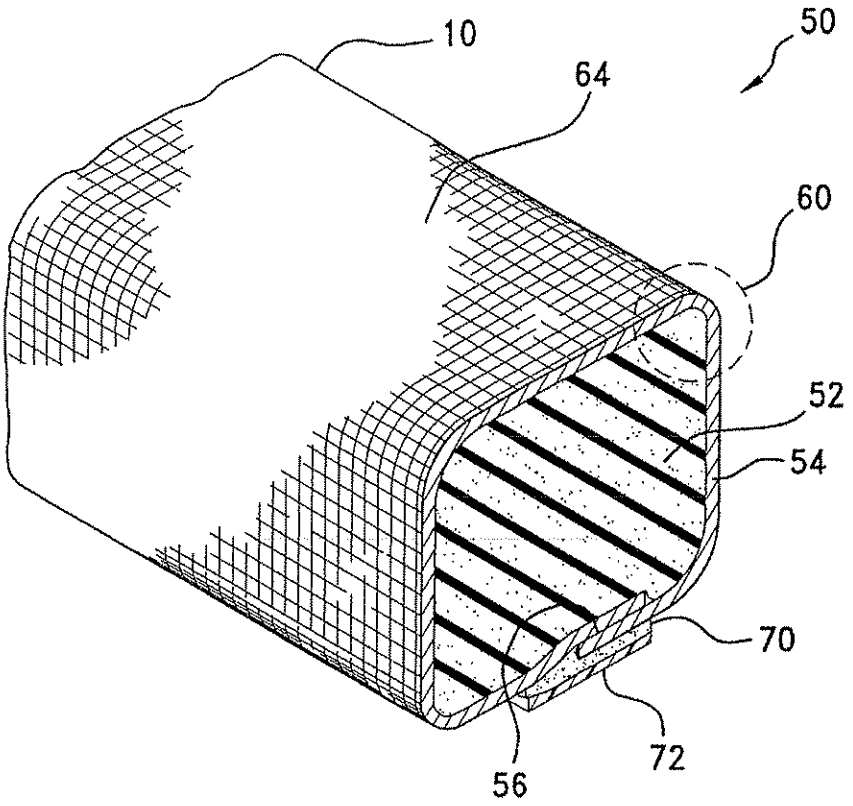

Fig. 4

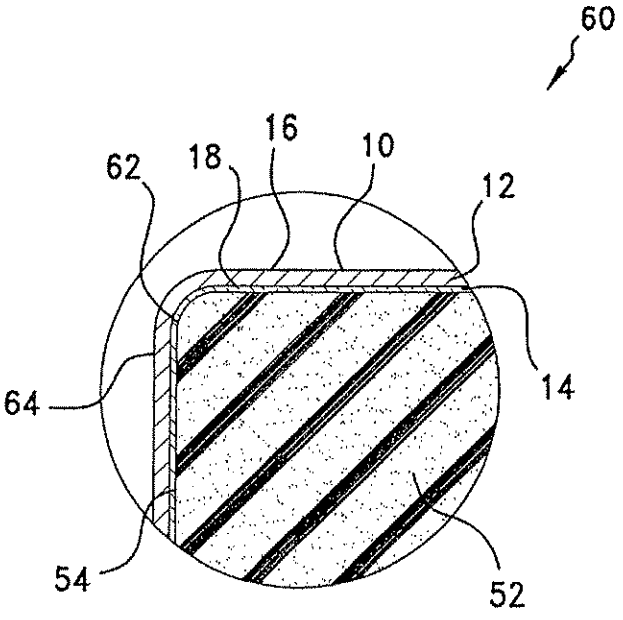

Fig. 5

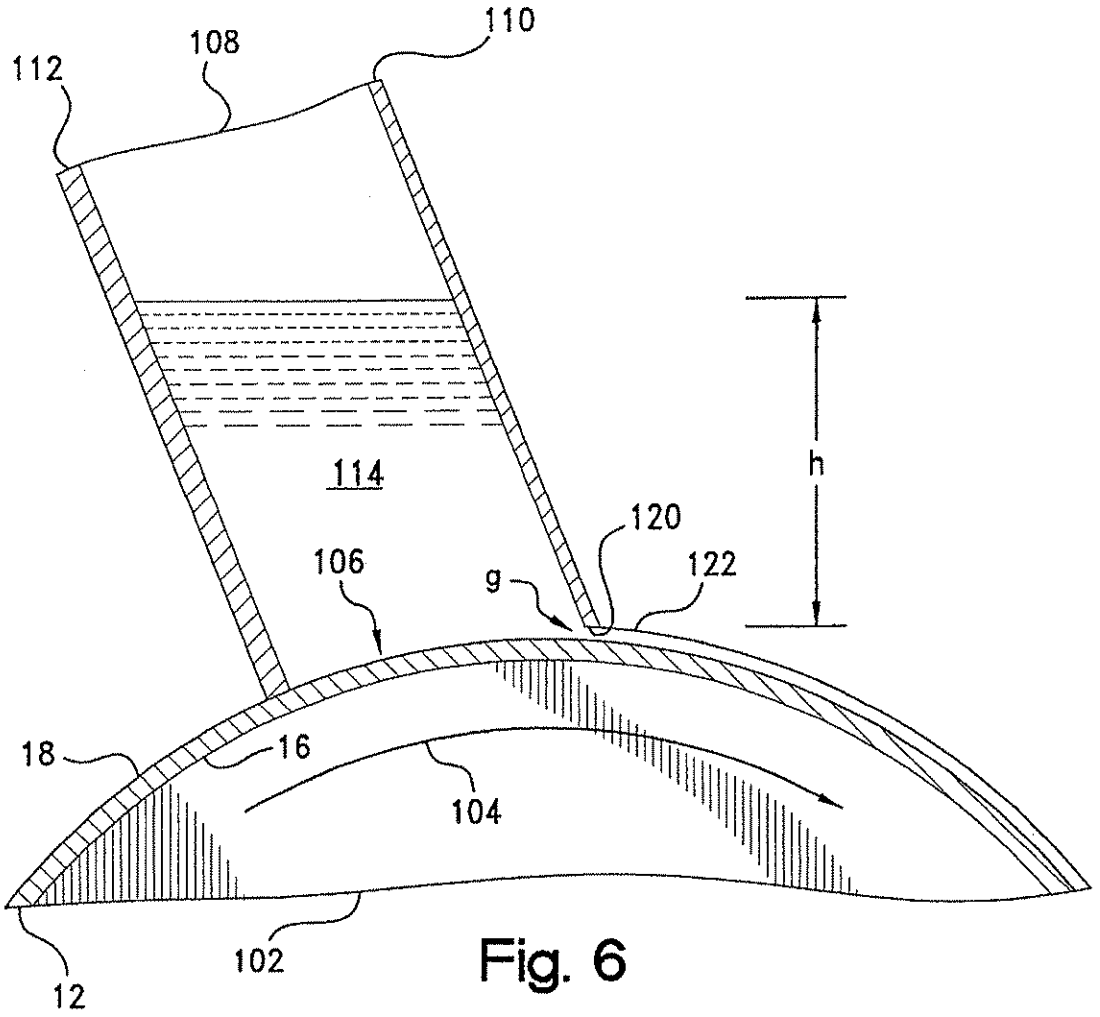

Fig. 6

FLAME RETARDANT EMI SHIELDING GASKET

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 09/883,785, filed Jun. 18, 2001, which application is to issue as U.S. Pat. No. 6,387,523; which is a continuation of U.S. application Ser. No. 09/250,338, filed Feb. 16, 1999, now U.S. Pat. No. 6,428,393 and claiming priority to U.S. provisional application Serial No. 60/076,370, filed Feb. 27, 1998, the disclosure of each of which is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates broadly to electrically-conductive, flame retardant materials for use in electromagnetic interference (EMI) shielding, and to a method of manufacturing the same, and more particularly to an electrically-conductive fabric having a layer of a flame retardant coating applied to one surface thereof for use as a sheathing within an EMI shielding gasket.

The operation of electronic devices including televisions, radios, computers, medical instruments, business machines, communications equipment, and the like is attended by the generation of electromagnetic radiation within the electronic circuitry of the equipment. Such radiation often develops as a field or as transients within the radio frequency band of the electromagnetic spectrum, i.e., between about 10 KHz and 10 GHz, and is termed "electromagnetic interference" or "EMI" as being known to interfere with the operation of other proximate electronic devices.

To attenuate EMI effects, shielding having the capability of absorbing and/or reflecting EMI energy may be employed both to confine the EMI energy within a source device, and to insulate that device or other "target" devices from other source devices. Such shielding is provided as a barrier which is inserted between the source and the other devices, and typically is configured as an electrically conductive and grounded housing which encloses the device. As the circuitry of the device generally must remain accessible for servicing or the like, most housings are provided with openable or removable accesses such as doors, hatches, panels, or covers. Between even the flattest of these accesses and its corresponding mating or faying surface, however, there may be present gaps which reduce the efficiency of the shielding by presenting openings through which radiant energy may leak or otherwise pass into or out of the device. Moreover, such gaps represent discontinuities in the surface and ground conductivity of the housing or other shielding, and may even generate a secondary source of EMI radiation by functioning as a form of slot antenna. In this regard, bulk or surface currents induced within the housing develop voltage gradients across any interface gaps in the shielding, which gaps thereby function as antennas which radiate EMI noise. In general, the amplitude of the noise is proportional to the gap length, with the width of the gap having a less appreciable effect.

For filling gaps within mating surfaces of housings and other EMI shielding structures, gaskets and other seals have been proposed both for maintaining electrical continuity across the structure, and for excluding from the interior of the device such contaminates as moisture and dust. Such seals are bonded or mechanically attached to, or press-fit into, one of the mating surfaces, and function to close any interface gaps to establish a continuous conductive path

thereacross by conforming under an applied pressure to irregularities between the surfaces. Accordingly, seals intended for EMI shielding applications are specified to be of a construction which not only provides electrical surface conductivity even while under compression, but which also has a resiliency allowing the seals to conform to the size of the gap. The seals additionally must be wear resistant, economical to manufacture, and capability of withstanding repeated compression and relaxation cycles. For further information on specifications for EMI shielding gaskets, reference may be had to Severinsen, J., "Gaskets That Block EMI," Machine Design, Vol. 47, No. 19, pp. 74–77 (Aug. 7, 1975).

Requirements for typical EMI shielding applications often dictate a low impedance, low profile gasket which is deflectable under normal closure force loads. Other requirements include low cost and a design which provides an EMI shielding effectiveness for both the proper operation of the device and compliance, in the United States, with commercial Federal Communication Commission (FCC) EMC regulations.

A particularly economical gasket construction, which also requires very low closure forces, i.e. less than about 1 lb/inch (0.175 N/mm), is marketed by the Chomerics Division of Parker-Hannifin Corp., Woburn, Mass. under the tradename "Soft-Shield® 5000 Series." Such construction consists of an electrically-conductive jacket or sheathing which is "cigarette" wrapped lengthwise over a polyurethane or other foam core. As is described further in U.S. Pat. No. 4,871,477, polyurethane foams generally are produced by the reaction of polyisocyanate and a hydroxyl-functional polyol in the presence of a blowing agent. The blowing agent effects the expansion of the polymer structure into a multiplicity of open or closed cells.

The jacket is provided as a highly conductive, i.e., about 1 Ω-sq., nickel-plated-silver, woven rip-stop nylon which is self-terminating when cut. Advantageously, the jacket may be bonded to the core in a continuous molding process wherein the foam is blown or expanded within the jacket as the jacket is wrapped around the expanding foam and the foam and jacket are passed through a die and into a traveling molding. Similar gasket constructions are shown in commonly-assigned U.S. Pat. No. 5,028,739 and in U.S. Pat. Nos. 4,857,668; 5,054,635; 5,105,056; and 5,202,536.

Many electronic devices, including PC's and communication equipment, must not only comply with certain FCC requirements, but also must meet be approved under certain Underwriter's Laboratories (UL) standards for flame retardancy. In this regard, if each of the individual components within an electronic device is UL approved, then the device itself does not require separate approval. Ensuring UL approval for each component therefore reduces the cost of compliance for the manufacturer, and ultimately may result in cheaper goods for the consumer. For EMI shielding gaskets, however, such gaskets must be made flame retardant, i.e., achieving a rating of V-0 under UL Std. No. 94, "Tests for Flammability of Plastic Materials for Parts in Devices and Appliances" (1991), without compromising the electrical conductivity necessary for meeting EMI shielding requirements.

In this regard, and particularly with respect to EMI shielding gaskets of the above-described fabric over foam variety, it has long been recognized that foamed polymeric materials are flammable and, in certain circumstances, may present a fire hazard. Owing to their cellular structure, high organic content, and surface area, most foam materials are

subject to relatively rapid decomposition upon exposure to fire or high temperatures.

One approach for imparting flame retardancy to fabric over foam gaskets has been to employ the sheathing as a flame resistant protective layer for the foam. Indeed, V-0 rating compliance purportedly has been achieved by sheathing the foam within an electrically-conductive Ni/Cu-plated fabric to which a thermoplastic sheet is hot nipped or otherwise fusion bonding to the underside thereof. Such fabrics, which may be further described in one or more of U.S. Pat. Nos. 4,489,126; 4,531,994; 4,608,104; and/or 4,621,013, have been marketed by Monsanto Co., St. Louis, under the tradename "Flectron® Ni/Cu Polyester Taffeta V0."

Other fabric over foam gaskets, as is detailed in U.S. Pat. No. 4,857,668, incorporate a supplemental layer or coating applied to the interior surface of the sheath. Such coating may be a flame-retardant urethane formulation which also promotes the adhesion of the sheath to the foam. The coating additionally may function to reduce bleeding of the foam through the fabric which otherwise could compromise the electrical conductivity of the sheath.

In view of the foregoing, it will be appreciated that further improvements in the design of flame retardant, fabric-over foam EMI shielding gaskets, as well as sheathing materials therefore, would be well-received by the electronics industry. Especially desired would be a flame retardant gasket construction which achieves a UL94 rating of V-0.

BROAD STATEMENT OF THE INVENTION

The present invention is directed to an electrically-conductive, flame retardant material for use in fabric-over-foam EMI shielding gaskets, and to a method of manufacturing the same. In having a layer of a flame retardant coating applied to one side of an electrically-conductive, generally porous fabric, the material of the invention affords UL94 V-0 protection when used as a jacketing in a fabric-over-foam gasket construction. Advantageously, as the flame retardant layer may be wet coated on the fabric without appreciable bleed through, a relatively thin, i.e., 2–4 mil (0.05–0.10 mm), coating layer may be provided on one fabric side without compromising the electrical surface conductivity of the other side. Such a thin coating layer, while being sufficient to provide UL94 V-0 protection, nonetheless maintains the drapability the fabric and thereby facilitates the construction UL94 V-0 compliant gaskets having complex profiles or narrow cross-sections down to about 1 mm.

In a preferred embodiment, the electrically-conductive, flame retardant EMI shielding material of the invention includes a nickel or silver-plated, woven nylon, polyester, or like fabric on one side of which is wet coated a layer of a flame retardant, acrylic latex emulsion or other fluent resin composition. In accordance with the precepts of the method of the invention, the viscosity and hydrodynamic pressure of the emulsion are controlled such that the coating does not penetrate or otherwise "bleed through" the uncoated side of the fabric. The surface conductivity of the opposite side of the fabric therefore is not compromised in EMI shielding applications.

The material of the invention may be employed as a jacket in fabric-over-foam EMI shielding gasket constructions, and is particularly adapted for use in the continuous molding process for such gaskets. As used within such process, the fabric may be wrapped around the foam as a jacket with coated side thereof being disposed as an interior surface

adjacent the foam, and the uncoated side being disposed as an electrically-conductive exterior surface. Advantageously, the coating on the interior surface of the jacket blocks the pores of the fabric to retain the foam therein without penetrate or bleed through to the exterior surface. In being formed of a acrylic material, the coated interior surface of the jacket may function, moreover, depending upon the composition of the foam, as a compatibilizing or "tie" interlayer which promotes the bonding of the foam to the fabric.

The present invention, accordingly, comprises material and method possessing the construction, combination of elements, and arrangement of parts and steps which are exemplified in the detailed disclosure to follow. Advantages of the present invention include a flame retardant yet drapable EMI shielding fabric. Additional advantages include an economical, flame retardant EMI shielding fabric construction wherein a relatively thin layer of a flame retardant coating may be wet coated onto one side of an electrically-conductive, woven or other generally porous EMI shielding fabric without compromising the conductivity of the other side of the fabric. These and other advantages will be readily apparent to those skilled in the art based upon the disclosure contained herein.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIG. **1** is a perspective view of one embodiment of an EMI shielding material according to the present invention which material includes a generally planar fabric member on one side of which is coated a layer of a flame retardant composition, the view being shown with portions being broken away to better reveal the structure of the material;

FIG. **2** is an enlarged cross-sectional view of the EMI shielding material of FIG. **1** taken through plane represented by line **2**—**2** of FIG. **1**;

FIG. **3** is a top view of the material of FIG. **1** which is magnified to reveal the structure of the fabric member thereof;

FIG. **4** is a perspective cross-sectional view of a length of a representative EMI shielding gasket construction according to the present invention including a jacket which is formed of the EMI shielding material of FIG. **1**;

FIG. **5** is an end view of the gasket of FIG. **4** which is magnified to reveal the structure thereof; and

FIG. **6** is a schematic, partially cross-sectional view of an illustrative gravity-fed, knife over roll coater as adapted for use in the manufacture of the EMI shielding material of FIG. **1**.

The drawings will be described further in connection with the following Detailed Description of the Invention.

DETAILED DESCRIPTION OF THE INVENTION

Certain terminology may be employed in the description to follow for convenience rather than for any limiting purpose. For example, the terms "upper" and "lower" designate directions in the drawings to which reference is made, with the terms "inner" or "interior" and "outer" or "exterior" referring, respectively, to directions toward and away from the center of the referenced element, and the terms "radial" and "axial" referring, respectively, to directions perpendicu-

lar and parallel to the longitudinal central axis of the referenced element. Terminology of similar import other than the words specifically mentioned above likewise is to be considered as being used for purposes of convenience rather than in any limiting sense.

For the illustrative purposes of the discourse to follow, the electromagnetic interference (EMI) shielding material herein involved is described in connection with its use as a flame retardant, electrically-conductive jacket for a foam core, EMI shielding gasket as may be adapted to be received within an interface, such as between a door, panel, hatch, cover, or other parting line of an electromagnetic interference (EMI) shielding structure. The EMI shielding structure may be the conductive housing of a computer, communications equipment, or other electronic device or equipment which generates EMI radiation or is susceptible to the effects thereof. The gasket may be bonded or fastened to, or press-fit into one of a pair of mating surfaces which define the interface within the housing, and functions between the mating surfaces to seal any interface gaps or other irregularities. That is, while under an applied pressure, the gasket resiliently conforms to any such irregularities both to establish a continuous conductive path across the interface, and to environmentally seal the interior of the housing against the ingress of dust, moisture, or other contaminates. It will be appreciated, however, that aspects of the present invention may find utility in other EMI shielding applications. Use within those such other applications therefore should be considered to be expressly within the scope of the present invention.

Referring then to the figures, wherein corresponding reference characters are used to designate corresponding elements throughout the several views, a flame retardant EMI shielding material according to the present invention is shown generally at 10 in FIG. **1** as generally adapted for use as a jacket within for a foam core gasket construction. For purposes of illustration, material sheet **10** is shown to be of indefinite dimensions which may be cut to size for the particular application envisioned. In basic construction, material **10** includes an upper, generally planar and porous fabric member, **12**, and a lower, flame retardant coating member, **14**.

Fabric member has at least an electrically-conductive first side, **16**, and a conductive or non-conductive second side, **18**, defining a thickness dimension, referenced at "t_1" in the cross-sectional view of FIG. **2**, which may vary from about 2–4 mils (0.05–0.10 mm). By "electrically-conductive," it is meant that the fabric may be rendered conductive, i.e., to a surface resistivity of about 0.1 Ω/sq. or less, by reason of its being constructed of electrically-conductive wire, monofilaments, yams or other fibers or, alternatively, by reason of a treatment such as a plating or sputtering being applied to non-conductive fibers to provide an electrically-conductive layer thereon. Preferred electrically-conductive fibers include Monel nickel-copper alloy, silver-plated copper, nickel-clad copper, Ferrex® tin-plated copper-clad steel, aluminum, tin-clad copper, phosphor bronze, carbon, graphite, and conductive polymers. Preferred non-conductive fibers include cotton, wool, silk, cellulose, polyester, polyamide, nylon, and polyimide monofilaments or yarns which are rendered electrically conductive with a metal plating of copper, nickel, silver, nickel-plated-silver, aluminum, tin, or an alloy thereof. As is known, the metal plating may applied to individual fiber strands or to the surfaces of the fabric after weaving, knitting, or other fabrication.

While fabrics such as wire meshes, knits, and non-woven cloths and webs may find application, a preferred fabric

construction for member **12** is a plain weave nylon or polyester cloth which is made electrically conductive with between about 20–40% by weight based on the total fabric weight, i.e., 0.01–0.10 g/in^2, of a silver, nickel-silver, or silver-nickel over copper plating. As may be seen in the magnified view of FIG. **1** referenced at **20** in FIG. **3**, such cloth is permeable in having a plain, generally square weave pattern with pores or openings, one of which is referenced at **22**, being defined between the fibers which are represented schematically at **24**. Fibers **24** may be yams, monofilaments or, preferably, bundles of from about 10–20 filaments or threads, each having a diameter of between about 10–50 gm. For example, with fibers **24** each being a bundle of such threads with a thread count of between about 1000–3000 per inch and a weave count of between about 1000–1500 per inch, 1000–2000 openings per inch will be defined with a mean average pore size of between about 0.5–2 mils (12.5–50 μm).

Although a plain, square weave pattern such as a taffeta, tabby, or ripstop is considered preferred, other weaves such as satins, twills, and the like also should be considered within the scope of the invention herein involved. A particularly preferred cloth for fabric member **12** is a 4 mil (0.10 mm) thick, 1.8 oz/yd^2 weight, silver-plated, woven nylon which is marketed commercially under the designation "31EN RIPSTOP" by Swift Textile Metalizing Corp., Bloomfield, Conn. However, depending upon the needs of the specific shielding application, a fabric constructed of a combination or blend of conductive and nonconductive fibers alternatively may be employed. Examples of fabrics woven, braided, or warp knitted from electrically-conductive fibers, or from blends of conductive and non-conductive fibers, are described in Gladfelter, U.S. Pat. No. 4,684,762, and in Buonanno, U.S. Pat. No. 4,857,668.

Returning to FIGS. **1** and **2**, coating member **14** preferably is formed from a curable layer of a fluent, flame retardant resin or other composition which is wet coated onto the second side **18** of fabric member **12**. As is detailed hereinafter, the viscosity and hydrodynamic pressure of the resin composition are controlled in accordance with the precepts of the present invention to delimit the penetration of the resin layer to a depth, referenced at "d" in FIG. **2**, which is less than the thickness dimension t_1 of the fabric member **12**. In this regard, when the layer is cured to form the flame retardant surface coating member **14** on the second side **18** of fabric member **12**, the first side **16** thereof remains electrically-conductive. In a preferred construction, the layer is coated to a wet thickness of about 10 mils (0.25 mm), and then cured to a dried coating or film thickness, referenced at t_2 in FIG. **2**, of between about 2–4 mils (0.05–0.10 mm) at a depth d of about 1–2 mils (0.025–0.05 mm). Ultimately, a total material thickness, referenced at "T," of between about 6–7 mils (0.15–0.20 mm) and a dried weight pickup of between about 100–150 g/yd^2 are observed. By "cured" it is meant that the resin is polymerized, cross-linked, further cross-linked or polymerized, vulcanized, hardened, dried, volatilized, or otherwise chemically or physically changed from a liquid or other fluent form into a solid polymeric or elastomeric phase.

The flame retardant composition preferably is formulated as an aqueous emulsion of an acrylic latex emulsion which is adjusted to a total solids of about 60% and a Brookfield viscosity (#5 spindle, 4 speed) of between about 40,000–60,000 cps, at a density of about 10 lbs per gallon (1.8 g/cm^3). Flame retardancy may be imparted by loading the emulsion with between about 30–50% by weight of one or more conventional flame retardant additives such as aluminum

hydrate, antimony trioxide, phosphate esters, or halogenated compounds such as polybrominated diphenyl oxides. A preferred formulation is a mixture of about 25% by weight, based on the total weight of the emulsion, of decambromodiphenyl oxide and about 15% by weight of one or more antimony compounds. In operation, should the acrylic carrier phase be ignited, the decomposition of the halogenated and metal oxide compounds function to chemically deprive the flame of sufficient oxygen to support combustion. The decomposition of the acrylic phase additionally may lead to the development of a protective, i.e., thermally-insulative or refractory, outer char layer.

A preferred flame retardant, acrylic latex emulsion is marketed commercially by Heveatex Corp., Fall River, Mass., under the designation "4129FR." The viscosity of the emulsion may be adjusted to between about 40,000–60,000 cps using an aqueous acryloid gel or other acrylic thickener. In this regard, the increased viscosity of the emulsion contributes to delimiting the penetration of the coating layer into the fabric member. However, as this relatively high viscosity may lead to undesirable porosity in the dried film, the emulsion additionally may be modified to reduce air entrapment and bubble formation in the coating layer with up to about 1% by weight of one or more commercial surfactants such as "Bubble Breaker" by Witco Chemical Corp. (Chicago, Ill.) and "Foam Master Antifoam" by Diamond Shamrock, Inc. (San Antonio, Tex.).

As aforementioned, EMI shielding material **10** of the present invention is particularly adapted for use as a flame retardant, electrically-conductive jacket which is provided over a foam core in an EMI shielding gasket construction such as gasket **50** of FIG. **4**. In a representative embodiment, gasket **50** includes an elongate, resilient foam core member, **52**, which may be of an indefinite length. Core member **52** has an outer circumferential surface, **54**, defining the cross-sectional profile of gasket **50** which, for illustrative purposes, is of a generally polygonal, i.e., square or rectangular geometry. Other plane profiles, such as circular, semicircular, or elliptical, or complex profiles may be substituted, however, depending upon the geometry of the interface to be sealed. Core member **12** may be of any radial or diametric extent, but for most applications will have a diametric extent or width of from about 0.25 inch (0.64 cm) to 1 inch (2.54 cm).

For affording gap-filling capabilities, it is preferred that core member **52** is provided to be complaint over a wide range of temperatures, and to exhibit good compression-relaxation hysteresis even after repeated cyclings or long compressive dwells. Core member **52** therefore may be formed of a foamed elastomeric thermoplastic such as a polyethylene, polypropylene, polypropylene-EPDM blend, butadiene, styrene-butadiene, nitrile, chlorosulfonate, or a foamed neoprene, urethane, or silicone. Preferred materials of construction include open or closed cell urethanes or blends such as a polyolefin resin/monoolefin copolymer blend, or a neoprene, silicone, or nitrile sponge rubber.

Core member **52** may be provided as an extruded or molded foam profile over which shielding material **10** is wrapped as a sheathed, with the edges of sheathed being overlapped as at **56**. In a preferred construction, shielding material **10** is bonded to the core member **52** in a continuous molding process wherein the foam is blown or expanded within the shielding material. As may be seen best with reference to the magnified view of FIG. **4** referenced at **60** in FIG. **5**, in such construction coating member **14** is disposed adjacent core member **52** as an interior surface, **62**, of shielding member **10**, with the uncoated side **16** of fabric member **12** being oppositely disposed as an electrically-conductive exterior surface, **64**, of the gasket **50**. It will be appreciated that the coated interior surface **62** blocks the pores **22** (FIG. **3**) of the fabric member **12** of the fabric to retain the blown foam therein without penetrate or bleed through to the exterior gasket surface **64**. Depending upon the respective compositions of the foam and coating, the interior surface **62** may function, moreover, as a compatibilizing or "tie" interlayer which promotes the bonding of the foam to the fabric. Gasket construction **50** advantageously provides a structure that may be used in very low closure force, i.e. less than about 1 lb/inch (0.175 N/mm), applications.

Referring again to FIG. **4**, an adhesive layer, **70**, may be applied along the lengthwise extent of gasket **50** to the underside of exterior surface **64** for the attachment of the gasket to a substrate. Such layer **70** preferably is formulated to be of a pressure sensitive adhesive (PSA) variety. As is described in U.S. Pat. No. 4,988,550, suitable PSA's for EMI shielding applications include formulations based on silicones, neoprene, styrene butadiene copolymers, acrylics, acrylates, polyvinyl ethers, polyvinyl acetate copolymers, polyisobutylenes, and mixtures, blends, and copolymers thereof. Acrylic-based formulations, however, generally are considered to be preferred for the EMI applications of the type herein involved. Although PSA's are preferred for adhesive layer **70**, other adhesives such as epoxies and urethanes may be substituted and, accordingly, are to be considered within the scope of the present invention. Heat-fusible adhesives such a hot-melts and thermoplastic films additionally may find applicability.

Inasmuch as the bulk conductivity of gasket **50** is determined substantially through its surface contact with the substrate, an electrically-conductive PSA may be preferred to ensure optimal EMI shielding performance. Such adhesives conventionally are formulated as containing about 1–25% by weight of a conductive filler to yield a volume resistivity of from about 0.01–0.001 Ω-cm. The filler may be incorporated in the form of particles, fibers, flakes, microspheres, or microballoons, and may range in size of from about 1–100 microns. Typically filler materials include inherently conductive material such as metals, carbon, and graphite, or nonconductive materials such as plastic or glass having a plating of a conductive material such as a noble metal or the like. In this regard, the means by which the adhesive is rendered electrically conductive is not considered to be a critical aspect of the present invention, such that any means achieving the desired conductivity and adhesion are to be considered suitable.

For protecting the outer portion of adhesive layer **70** which is exposed on the exterior surface of the gasket, a release sheets, shown at **72**, may be provided as removably attached to the exposed adhesive. As is common in the adhesive art, release sheet **72** may be provided as strip of a waxed, siliconized, or other coated paper or plastic sheet or the like having a relatively low surface energy so as to be removable without appreciable lifting of the adhesive from the exterior surface **64**.

In the production of commercial quantities of the EMI shielding material **10** of the present invention, the viscosity adjusted and otherwise modified acrylic latex emulsion or other resin composition may be coated and cured on one side the fabric member **12** by a direct wet process such as knife over roll or slot die. With whatever process is employed, the hydrodynamic pressure of the resin composition is controlled in accordance with the precepts of the present invention to delimit the penetration of the resin layer to a depth

which is less than the thickness dimension of the fabric member. For example, and with reference to FIG. **6** wherein the head of a representative gravity-fed knife over roll coater is shown somewhat schematically at **100**, porous, i.e., permeable, fabric member **12** is conveyed from a feed roll or the like (not shown) over a nip roller, **102**, which rotates in the direction referenced by arrow **104**. With the first side **16** of fabric member **12** supported on roller **102**, the fabric second side **18** is passed beneath the opening, referenced at **106**, of a coating trough, **108**. Trough **108** is defined by a front plate, **110**, a back plate, **112**, and a pair of side plates (not shown).

The emulsion or other fluent resin composition, referenced at **114**, is pumped or otherwise transported into trough **108** which is filled to a fluid level, referenced at h. For a given fluid density, this level h is controlled such that the hydrodynamic pressure at the fabric-liquid interface is maintained within preset limits. For example, with a fluid density of about 10 pounds per gallon (1.8 g/cm^3), and a fabric having a porosity of about 1000–2000 openings per inch with a mean average pore size of between about 0.5–2 mils (12.5–50 μm), the fluid level H is controlled at about 4 inches (10 cm) to yield a hydrodynamic pressure of about 0.05 psi (0.35 kPa) at the fabric-liquid interface. For other coating processes, the hydrodynamic fluid pressure may be controlled, for example, by a pumping pressure or the like.

In the illustrative knife-over-roll coating process, the lower edge, **120**, of front plate **110** defines a knife surface which is shimmed or otherwise spaced-apart a predetermined distance from the second side **18** of fabric member **12**. Such spacing provides a clearance or gap, referenced at "g," of typically about 10 mils (0.25 mm), but which is adjustable to regulate the thickness of the liquid coating layer, **122**, being applied to the fabric member. From roller **104**, the coated fabric member **12** may be conveyed via a take-up roller arrangement (not shown) through a in-line oven or the like to dry or flash the water or other diluent in the liquid coating layer **122**, or to otherwise cure the liquid coating layer **122** in developing an adherent, tack-free, film or other layer of coating member **14** (FIG. **1**) on the single side **18** of fabric member **12**.

The Example to follow, wherein all percentages and proportions are by weight unless otherwise expressly indicated, is illustrative of the practicing of the invention herein involved, but should not be construed in any limiting sense.

EXAMPLE

Representative EMI shielding materials according to the present invention were constructed for characterization. In this regard, a master batch of a flame retardant coating composition was compounded using an acrylic latex emulsion (Heveatex "4129FR"). The viscosity of the emulsion was adjusted to a Brookfield viscosity (#4 spindle, 40 speed) of about 60,000 cps with about 5 wt % of an acryloid thickener (Acrysol™ GS, Monsanto Co., St. Louis, Mo.). The modified emulsion had a total solids content of about 60% by weight, a density of about 10 pounds per gallon (1.8 g/cm^3), and a pH of between about 7.5 and 9.5.

The emulsion was applied using a knife over roll coater (JETZONE Model 7319, Wolverine Corp., Merrimac, Mass.) to one side of a silver-plated nylon fabric (Swift "31EN RIPSTOP") having a thickness of about 4 mils (0.1 mm). With the fluid level in the coating trough of the coater maintained at about 4 inch (10 cm), the emulsion was delivered to the surface of the cloth at a hydrodynamic pressure of about 0.05 psi (0.35 kPa). The coating knife was shimmed to a 10 mil (0.25 mm) gap above the fabric to yield a wet coating draw down thickness of about 10 mils. Following an oven curing at 100–125° C. for 5 minutes, a dried coating or film thickness of about 2.5 mils (0.635 mm) was obtained with a weight pickup of about 130–145 g/yd^2 and a total material thickness of between about 6–7 mils (0.15–0.18 mm). An inspection of the coated fabric cloth revealed a coating penetration depth of about 1–2 mils (0.02–0.05 mm) providing acceptable mechanical retention and/or adhesion of the coating onto the fabric surface. The opposite side of the fabric, however, was observed to be substantially coating free, and to retain a surface resistivity of about 0.1 Ω/sq for unaffected EMI shielding effectiveness.

Fabric samples similarly coated in the manner described were subjected to an in-house vertical flame test. No burning was observed at dried film thickness of 2, 3, or 4 mils (0.05, 0.08, 0.10 mm). Accordingly, a reasonable operating window of film thickness was suggested for production runs.

Samples also were provided, as jacketed over a polyurethane foam core in an EMI shielding gasket construction, for flame testing by Underwriters Laboratories, Inc., Melville, N.Y. A flame class rating of V-0 under UL94 was assigned at a minimum thickness of 1.0 mm. The gasket construction therefore was found to be compliant with the applicable UL requirements, and was approved to bear the "UL" certification mark.

The foregoing results confirm that the EMI shielding material of the present invention affords UL94 V-0 protection when used as a jacketing in a fabric-over-foam gasket construction. Unexpectedly, it was found that a relatively porous or permeable fabric may be wet coated on one side with a relatively thin, i.e., 2–4 mil (0.05–0.10 mm), coating layer of a flame retardant composition without compromising the electrical surface conductivity of the other side. Such a thin coating layer, while being sufficient to provide UL94 V-0 protection in a conventional fabric-over-foam gasket construction, nonetheless maintains the drapability the fabric and thereby facilitates the fabrication of UL94 V-0 compliant gaskets having complex profiles or narrow cross-sections down to about 1 mm.

As it is anticipated that certain changes may be made in the present invention without departing from the precepts herein involved, it is intended that all matter contained in the foregoing description shall be interpreted as illustrative and not in a limiting sense. All references cited herein are expressly incorporated by reference.

What is claimed is:

1. A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member which is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94 extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame

retardant layer being effective to afford said gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94 and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

2. The gasket of claim 1 wherein said flame retardant layer has a thickness of between about 2–4 mils (0.05–0.10 mm).

3. The gasket of claim 1 wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion.

4. The gasket of claim 1 wherein said fabric member is a metal-plated cloth.

5. The gasket of claim 4 wherein said cloth comprises fibers selected from the group consisting of cotton, wool, silk, cellulose, polyester, polyamide, nylon, and combinations thereof, and said metal is selected from the group consisting of copper, nickel, silver, nickel-plated-silver, aluminum, tin, and combinations thereof.

6. The gasket of claim 1 wherein said foamed elastomeric material is selected from the group consisting of polyethylenes, polypropylenes, polypropylene-EPDM blends, butadienes, styrene-butadienes, nitriles, chlorosulfonates, neoprenes, urethanes, silicones, and polyolefin resin/monoolefin copolymer blends, and combinations thereof.

7. The gasket of claim 1 wherein said fabric member has a thickness of between about 2–4 mils (0.05–0.10 mm).

8. A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer comprising between about 30–50% by weight of one or more flame retardant additives and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

9. The gasket of claim 8 wherein said flame retardant layer has a thickness of between about 2–4 mils (0.05–0.10 mm).

10. The gasket of claim 8 wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion.

11. The gasket of claim 8 wherein said fabric member is a metal-plated cloth.

12. The gasket of claim 11 wherein said cloth comprises fibers selected from the group consisting of cotton, wool, silk, cellulose, polyester, polyamide, nylon, and combinations thereof, and said metal is selected from the group consisting of copper, nickel, silver, nickel-plated-silver, aluminum, tin, and combinations thereof.

13. The gasket of claim 8 wherein said foamed elastomeric material is selected from the group consisting of polyethylenes, polypropylenes, polypropylene-EPDM blends, butadienes, styrene-butadienes, nitriles, chlorosulfonates, neoprenes, urethanes, silicones, and polyolefin resin/monoolefin copolymer blends, and combinations thereof.

14. The gasket of claim 8 wherein said fabric member has a thickness of between about 2–4 mils (0.05–0.10 mm).

15. The gasket of claim 8 wherein said flame retardant layer is effective to afford the gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

16. The gasket of claim 15 wherein said core member is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94.

17. The gasket of claim 8 wherein said core member is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94.

18. The gasket of claim 8 wherein said one or more flame retardant additives are selected from the group consisting of aluminum hydrate, antimony trioxide, phosphate esters, and halogenated compounds.

* * * * *

EXHIBIT B

US006716536B2

(12) **United States Patent**
Bunyan et al.

(10) **Patent No.: US 6,716,536 B2**
(45) **Date of Patent: *Apr. 6, 2004**

(54) **FLAME RETARDANT EMI SHIELDING GASKET**

(75) Inventors: **Michael H. Bunyan**, Chelmsford, MA (US); **William I. Flanders**, Merimack, NH (US)

(73) Assignee: **Parker-Hannifin Corporation**, Cleveland, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/318,609**

(22) Filed: **Dec. 11, 2002**

(65) **Prior Publication Data**

US 2003/0124934 A1 Jul. 3, 2003

Related U.S. Application Data

(63) Continuation of application No. 10/142,803, filed on May 9, 2002, now Pat. No. 6,521,348, which is a continuation of application No. 09/883,785, filed on Jun. 18, 2001, now Pat. No. 6,387,523, which is a continuation of application No. 09/250,338, filed on Feb. 16, 1999, now Pat. No. 6,248,393.

(60) Provisional application No. 60/076,370, filed on Feb. 27, 1998.

(51) **Int. Cl.**[7] **B32B 5/14**; B32B 5/18; H05K 9/00

(52) **U.S. Cl.** **428/457**; 361/818

(58) **Field of Search** 428/457; 361/818

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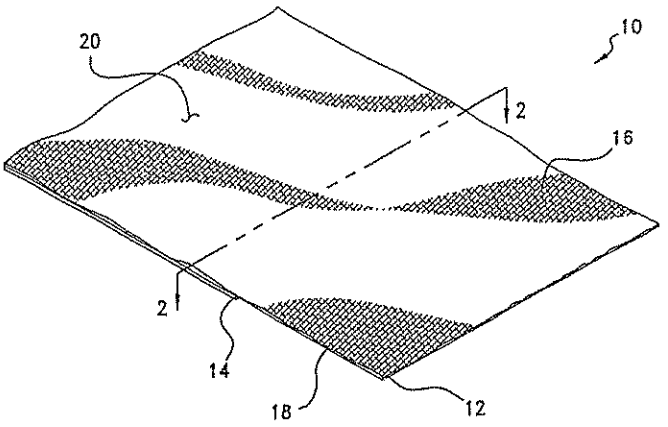
Primary Examiner—Erma Cameron
(74) *Attorney, Agent, or Firm*—John A. Molnar, Jr.

(57) **ABSTRACT**

A flame retardant, electromagnetic interference (EMI) shielding gasket construction. The construction includes a resilient core member formed of a foamed elastomeric material, an electrically-conductive fabric member surrounding the outer surface of the core member, and a flame retardant layer coating at least a portion of the interior surface of the fabric member. The flame retardant layer is effective to afford the gasket construction with a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

9 Claims, 3 Drawing Sheets



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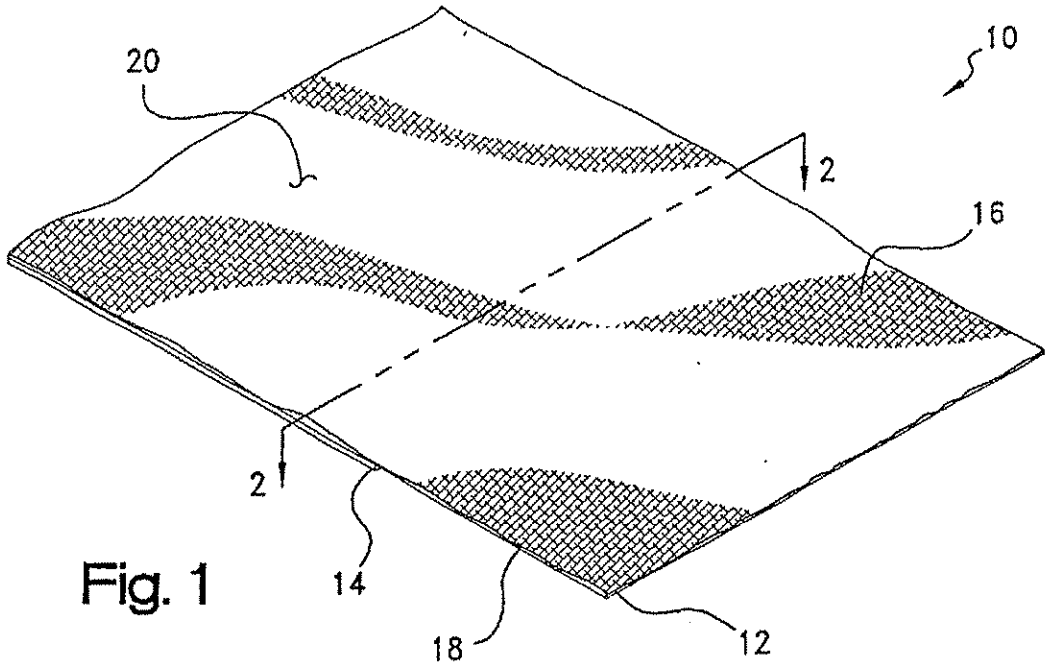

Fig. 1

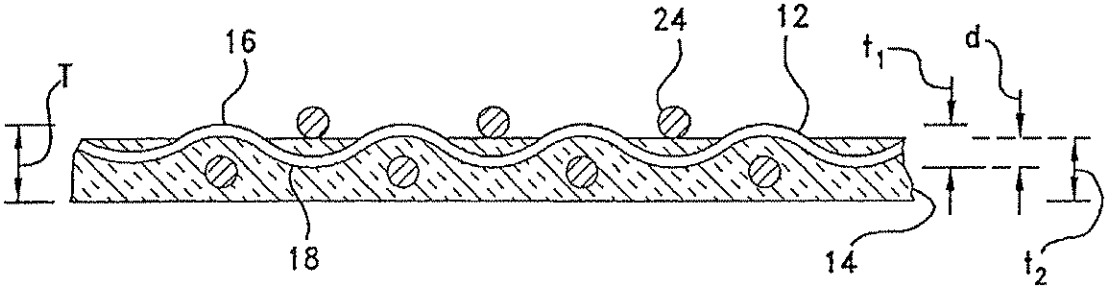

Fig. 2

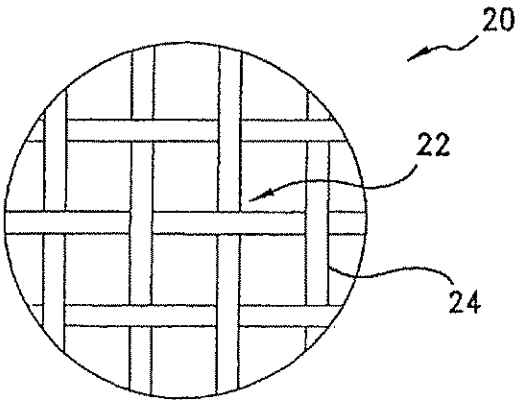

Fig. 3

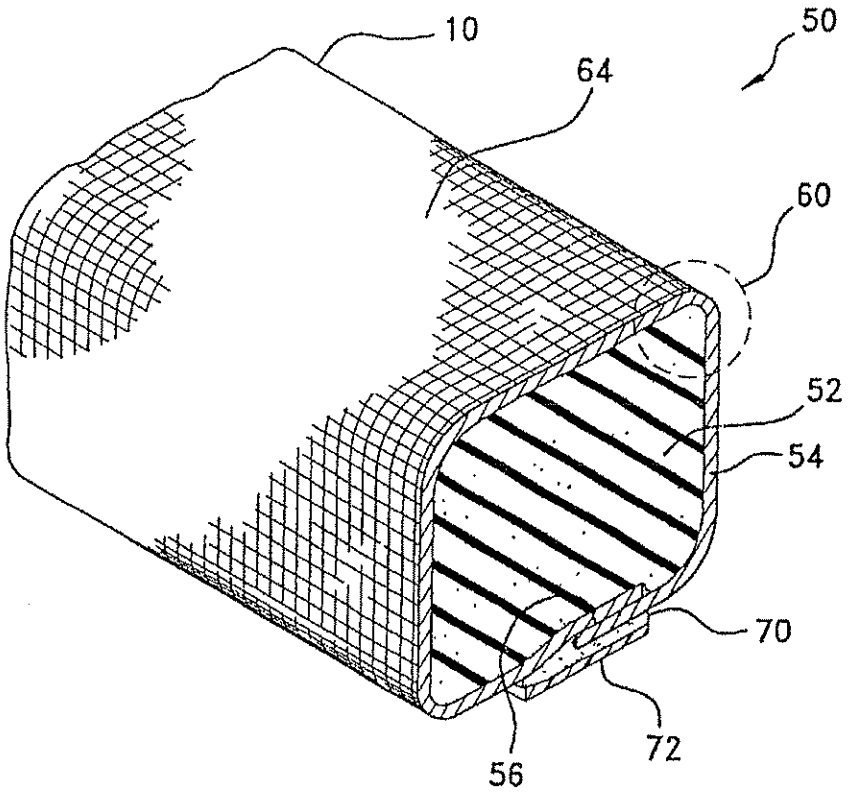

Fig. 4

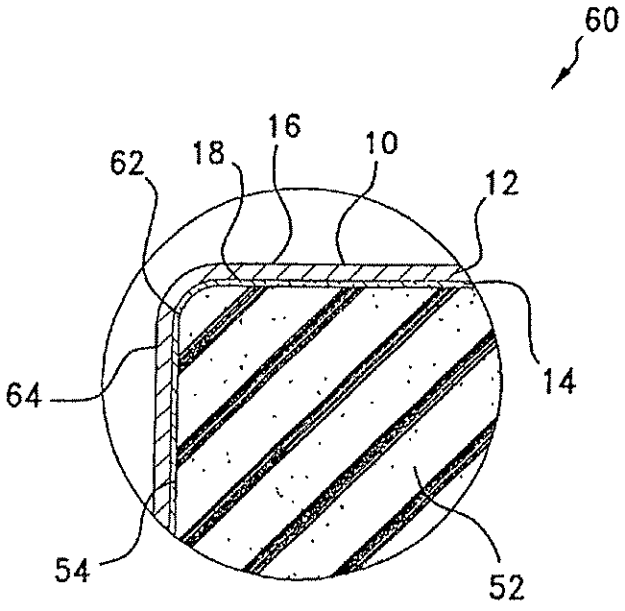

Fig. 5

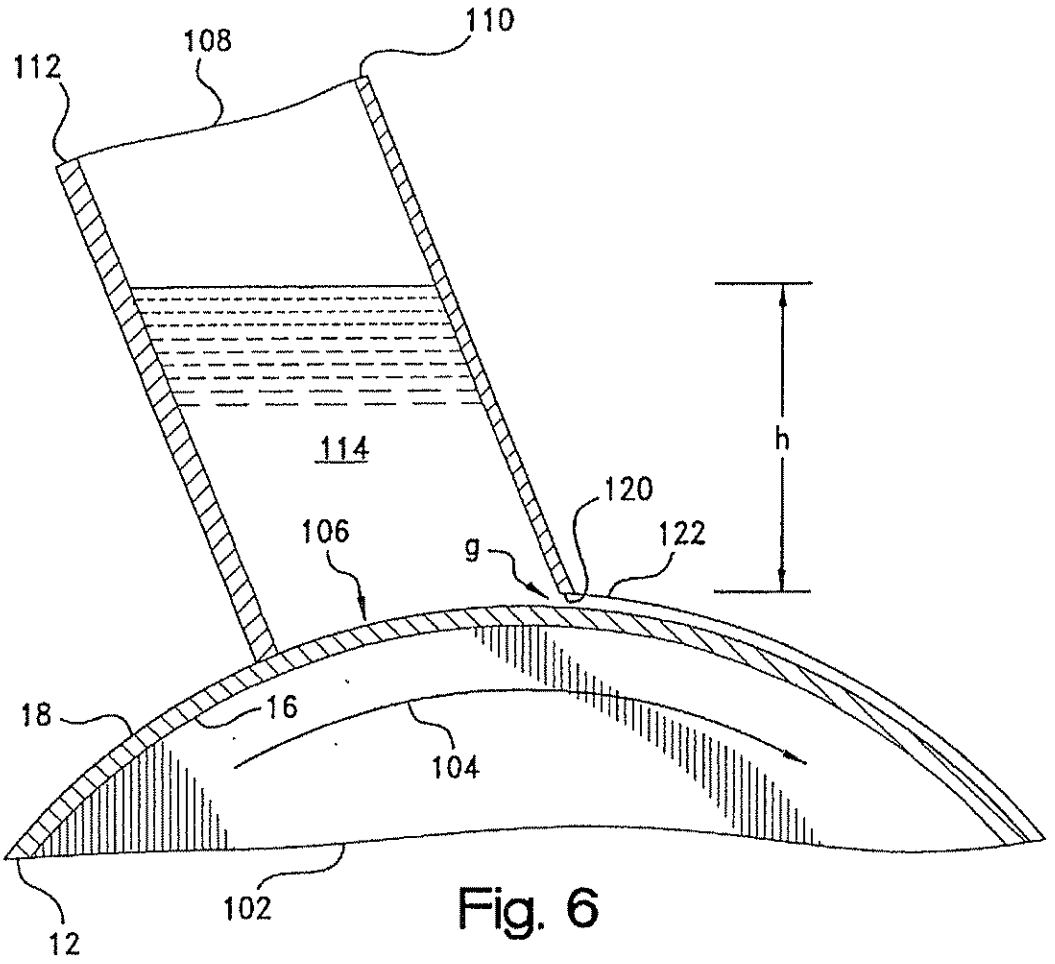

Fig. 6

FLAME RETARDANT EMI SHIELDING GASKET

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 10/142,803 filed May 9, 2002, now U.S. Pat. No. 6,521,348, which is a continuation of U.S. application Ser. No. 09/883,785, filed Jun. 18, 2001, now U.S. Pat. No. 6,387,523; which is a continuation of U.S. application Ser. No. 09/250,338, filed Feb. 16, 1999, now U.S. Pat. No. 6,248,393 and claiming priority to U.S. provisional application Ser. No. 60/076,370, filed Feb. 27, 1998, the disclosure of each of which is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates broadly to electrically-conductive, flame retardant materials for use in electromagnetic interference (EMI) shielding, and to a method of manufacturing the same, and more particularly to an electrically-conductive fabric having a layer of a flame retardant coating applied to one surface thereof for use as a sheathing within an EMI shielding gasket.

The operation of electronic devices including televisions, radios, computers, medical instruments, business machines, communications equipment, and the like is attended by the generation of electromagnetic radiation within the electronic circuitry of the equipment. Such radiation often develops as a field or as transients within the radio frequency band of the electromagnetic spectrum, i.e., between about 10 KHz and 10 GHz, and is termed "electromagnetic interference" or "EMI" as being known to interfere with the operation of other proximate electronic devices.

To attenuate EMI effects, shielding having the capability of absorbing and/or reflecting EMI energy may be employed both to confine the EMI energy within a source device, and to insulate that device or other "target" devices from other source devices. Such shielding is provided as a barrier which is inserted between the source and the other devices, and typically is configured as an electrically conductive and grounded housing which encloses the device. As the circuitry of the device generally must remain accessible for servicing or the like, most housings are provided with openable or removable accesses such as doors, hatches, panels, or covers. Between even the flattest of these accesses and its corresponding mating or faying surface, however, there may be present gaps which reduce the efficiency of the shielding by presenting openings through which radiant energy may leak or otherwise pass into or out of the device. Moreover, such gaps represent discontinuities in the surface and ground conductivity of the housing or other shielding, and may even generate a secondary source of EMI radiation by functioning as a form of slot antenna. In this regard, bulk or surface currents induced within the housing develop voltage gradients across any interface gaps in the shielding, which gaps thereby function as antennas which radiate EMI noise. In general, the amplitude of the noise is proportional to the gap length, with the width of the gap having a less appreciable effect.

For filling gaps within mating surfaces of housings and other EMI shielding structures, gaskets and other seals have been proposed both for maintaining electrical continuity across the structure, and for excluding from the interior of the device such contaminates as moisture and dust. Such seals are bonded or mechanically attached to, or press-fit into, one of the mating surfaces, and function to close any interface gaps to establish a continuous conductive path thereacross by conforming under an applied pressure to irregularities between the surfaces. Accordingly, seals intended for EMI shielding applications are specified to be of a construction which not only provides electrical surface conductivity even while under compression, but which also has a resiliency allowing the seals to conform to the size of the gap. The seals additionally must be wear resistant, economical to manufacture, and capability of withstanding repeated compression and relaxation cycles. For further information on specifications for EMI shielding gaskets, reference may be had to Severinsen, J., "Gaskets That Block EMI," Machine Design, Vol. 47, No. 19, pp. 74–77 (Aug. 7, 1975).

Requirements for typical EMI shielding applications often dictate a low impedance, low profile gasket which is deflectable under normal closure force loads. Other requirements include low cost and a design which provides an EMI shielding effectiveness for both the proper operation of the device and compliance, in the United States, with commercial Federal Communication Commission (FCC) EMC regulations.

A particularly economical gasket construction, which also requires very low closure forces, i.e. less than about 1 lb/inch (0.175 N/mm), is marketed by the Chomerics Division of Parker-Hannifin Corp., Woburn, Mass. under the tradename "Soft-Shield® 5000 Series." Such construction consists of an electrically-conductive jacket or sheathing which is "cigarette" wrapped lengthwise over a polyurethane or other foam core. As is described further in U.S. Pat. No. 4,871,477, polyurethane foams generally are produced by the reaction of polyisocyanate and a hydroxyl-functional polyol in the presence of a blowing agent. The blowing agent effects the expansion of the polymer structure into a multiplicity of open or closed cells.

The jacket is provided as a highly conductive, i.e., about 1 Ω-sq., nickel-plated-silver, woven rip-stop nylon which is self-terminating when cut. Advantageously, the jacket may be bonded to the core in a continuous molding process wherein the foam is blown or expanded within the jacket as the jacket is wrapped around the expanding foam and the foam and jacket are passed through a die and into a traveling molding. Similar gasket constructions are shown in commonly-assigned U.S. Pat. No. 5,028,739 and in U.S. Pat. Nos. 4,857,668; 5,054,635; 5,105,056; and 5,202,536.

Many electronic devices, including PC's and communication equipment, must not only comply with certain FCC requirements, but also must meet be approved under certain Underwriter's Laboratories (UL) standards for flame retardancy. In this regard, if each of the individual components within an electronic device is UL approved, then the device itself does not require separate approval. Ensuring UL approval for each component therefore reduces the cost of compliance for the manufacturer, and ultimately may result in cheaper goods for the consumer. For EMI shielding gaskets, however, such gaskets must be made flame retardant, i.e., achieving a rating of V-0 under UL Std. No. 94, "Tests for Flammability of Plastic Materials for Parts in Devices and Appliances" (1991), without compromising the electrical conductivity necessary for meeting EMI shielding requirements.

In this regard, and particularly with respect to EMI shielding gaskets of the above-described fabric over foam variety, it has long been recognized that foamed polymeric materials are flammable and, in certain circumstances, may

present a fire hazard. Owing to their cellular structure, high organic content, and surface area, most foam materials are subject to relatively rapid decomposition upon exposure to fire or high temperatures.

One approach for imparting flame retardancy to fabric over foam gaskets has been to employ the sheathing as a flame resistant protective layer for the foam. Indeed, V-0 rating compliance purportedly has been achieved by sheathing the foam within an electrically-conductive Ni/Cu-plated fabric to which a thermoplastic sheet is hot nipped or otherwise fusion bonding to the underside thereof. Such fabrics, which may be further described in one or more of U.S. Pat. Nos. 4,489,126; 4,531,994; 4,608,104; and/or 4,621,013, have been marketed by Monsanto Co., St. Louis, under the tradename "Flectron® Ni/Cu Polyester Taffeta V0."

Other fabric over foam gaskets, as is detailed in U.S. Pat. No. 4,857,668, incorporate a supplemental layer or coating applied to the interior surface of the sheath. Such coating may be a flame-retardant urethane formulation which also promotes the adhesion of the sheath to the foam. The coating additionally may function to reduce bleeding of the foam through the fabric which otherwise could compromise the electrical conductivity of the sheath.

In view of the foregoing, it will be appreciated that further improvements in the design of flame retardant, fabric-over foam EMI shielding gaskets, as well as sheathing materials therefore, would be well-received by the electronics industry. Especially desired would be a flame retardant gasket construction which achieves a UL94 rating of V-0.

BROAD STATEMENT OF THE INVENTION

The present invention is directed to an electrically-conductive, flame retardant material for use in fabric-over-foam EMI shielding gaskets, and to a method of manufacturing the same. In having a layer of a flame retardant coating applied to one side of an electrically-conductive, generally porous fabric, the material of the invention affords UL94 V-0 protection when used as a jacketing in a fabric-over-foam gasket construction. Advantageously, as the flame retardant layer may be wet coated on the fabric without appreciable bleed through, a relatively thin, i.e., 2–4 mil (0.05–0.10 mm), coating layer may be provided on one fabric side without compromising the electrical surface conductivity of the other side. Such a thin coating layer, while being sufficient to provide UL94 V-0 protection, nonetheless maintains the drapability the fabric and thereby facilitates the construction UL94 V-0 compliant gaskets having complex profiles or narrow cross-sections down to about 1 mm.

In a preferred embodiment, the electrically-conductive, flame retardant EMI shielding material of the invention includes a nickel or silver-plated, woven nylon, polyester, or like fabric on one side of which is wet coated a layer of a flame retardant, acrylic latex emulsion or other fluent resin composition. In accordance with the precepts of the method of the invention, the viscosity and hydrodynamic pressure of the emulsion are controlled such that the coating does not penetrate or otherwise "bleed through" the uncoated side of the fabric. The surface conductivity of the opposite side of the fabric therefore is not compromised in EMI shielding applications.

The material of the invention may be employed as a jacket in fabric-over-foam EMI shielding gasket constructions, and is particularly adapted for use in the continuous molding process for such gaskets. As used within such process, the fabric may be wrapped around the foam as a jacket with coated side thereof being disposed as an interior surface adjacent the foam, and the uncoated side being disposed as an electrically-conductive exterior surface. Advantageously, the coating on the interior surface of the jacket blocks the pores of the fabric to retain the foam therein without penetrate or bleed through to the exterior surface. In being formed of a acrylic material, the coated interior surface of the jacket may function, moreover, depending upon the composition of the foam, as a compatibilizing or "tie" interlayer which promotes the bonding of the foam to the fabric.

The present invention, accordingly, comprises material and method possessing the construction, combination of elements, and arrangement of parts and steps which are exemplified in the detailed disclosure to follow. Advantages of the present invention include a flame retardant yet drapable EMI shielding fabric. Additional advantages include an economical, flame retardant EMI shielding fabric construction wherein a relatively thin layer of a flame retardant coating may be wet coated onto one side of an electrically-conductive, woven or other generally porous EMI shielding fabric without compromising the conductivity of the other side of the fabric. These and other advantages will be readily apparent to those skilled in the art based upon the disclosure contained herein.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIG. **1** is a perspective view of one embodiment of an EMI shielding material according to the present invention which material includes a generally planar fabric member on one side of which is coated a layer of a flame retardant composition, the view being shown with portions being broken away to better reveal the structure of the material;

FIG. **2** is an enlarged cross-sectional view of the EMI shielding material of FIG. **1** taken through plane represented by line **2**—**2** of FIG. **1**;

FIG. **3** is a top view of the material of FIG. **1** which is magnified to reveal the structure of the fabric member thereof;

FIG. **4** is a perspective cross-sectional view of a length of a representative EMI shielding gasket construction according to the present invention including a jacket which is formed of the EMI shielding material of FIG. **1**;

FIG. **5** is an end view of the gasket of FIG. **4** which is magnified to reveal the structure thereof, and

FIG. **6** is a schematic, partially cross-sectional view of an illustrative gravity-fed, knife over roll coater as adapted for use in the manufacture of the EMI shielding material of FIG. **1**.

The drawings will be described further in connection with the following Detailed Description of the Invention.

DETAILED DESCRIPTION OF THE INVENTION

Certain terminology may be employed in the description to follow for convenience rather than for any limiting purpose. For example, the terms "upper" and "lower" designate directions in the drawings to which reference is made, with the terms "inner" or "interior" and "outer" or "exterior" referring, respectively, to directions toward and away from

the center of the referenced element, and the terms "radial" and "axial" referring, respectively, to directions perpendicular and parallel to the longitudinal central axis of the referenced element. Terminology of similar import other than the words specifically mentioned above likewise is to be considered as being used for purposes of convenience rather than in any limiting sense.

For the illustrative purposes of the discourse to follow, the electromagnetic interference (EMI) shielding material herein involved is described in connection with its use as a flame retardant, electrically-conductive jacket for a foam core, EMI shielding gasket as may be adapted to be received within an interface, such as between a door, panel, hatch, cover, or other parting line of an electromagnetic interference (EMI) shielding structure. The EMI shielding structure may be the conductive housing of a computer, communications equipment, or other electronic device or equipment which generates EMI radiation or is susceptible to the effects thereof. The gasket may be bonded or fastened to, or press-fit into one of a pair of mating surfaces which define the interface within the housing, and functions between the mating surfaces to seal any interface gaps or other irregularities. That is, while under an applied pressure, the gasket resiliently conforms to any such irregularities both to establish a continuous conductive path across the interface, and to environmentally seal the interior of the housing against the ingress of dust, moisture, or other contaminates. It will be appreciated, however, that aspects of the present invention may find utility in other EMI shielding applications. Use within those such other applications therefore should be considered to be expressly within the scope of the present invention.

Referring then to the figures, wherein corresponding reference characters are used to designate corresponding elements throughout the several views, a flame retardant EMI shielding material according to the present invention is shown generally at **10** in FIG. **1** as generally adapted for use as a jacket within for a foam core gasket construction. For purposes of illustration, material sheet **10** is shown to be of indefinite dimensions which may be cut to size for the particular application envisioned. In basic construction, material **10** includes an upper, generally planar and porous fabric member, **12**, and a lower, flame retardant coating member, **14**.

Fabric member has at least an electrically-conductive first side, **16**, and a conductive or non-conductive second side, **18**, defining a thickness dimension, referenced at "t," in the cross-sectional view of FIG. **2**, which may vary from about 2–4 mils (0.05–0.10 mm). By "electrically-conductive," it is meant that the fabric may be rendered conductive, i.e., to a surface resistivity of about 0.1 Ω/sq. or less, by reason of its being constructed of electrically-conductive wire, monofilaments, yarns or other fibers or, alternatively, by reason of a treatment such as a plating or sputtering being applied to non-conductive fibers to provide an electrically-conductive layer thereon. Preferred electrically-conductive fibers include Monel nickel-copper alloy, silver-plated copper, nickel-clad copper, Ferrex® tin-plated copper-clad steel, aluminum, tin-clad copper, phosphor bronze, carbon, graphite, and conductive polymers. Preferred non-conductive fibers include cotton, wool, silk, cellulose, polyester, polyamide, nylon, and polyimide monofilaments or yarns which are rendered electrically conductive with a metal plating of copper, nickel, silver, nickel-plated-silver, aluminum, tin, or an alloy thereof. As is known, the metal plating may applied to individual fiber strands or to the surfaces of the fabric after weaving, knitting, or other fabrication.

While fabrics such as wire meshes, knits, and non-woven cloths and webs may find application, a preferred fabric construction for member **12** is a plain weave nylon or polyester cloth which is made electrically conductive with between about 20–40% by weight based on the total fabric weight, i.e., 0.01–0.10 g/in^2, of a silver, nickel-silver, or silver-nickel over copper plating. As may be seen in the magnified view of FIG. **1** referenced at **20** in FIG. **3**, such cloth is permeable in having a plain, generally square weave pattern with pores or openings, one of which is referenced at **22**, being defined between the fibers which are represented schematically at **24**. Fibers **24** may be yarns, monofilaments or, preferably, bundles of from about 10–20 filaments or threads, each having a diameter of between about 10–50 μm. For example, with fibers **24** each being a bundle of such threads with a thread count of between about 1000–3000 per inch and a weave count of between about 1000–1500 per inch, 1000–2000 openings per inch will be defined with a mean average pore size of between about 0.5–2 mils (12.5–50 μm).

Although a plain, square weave pattern such as a taffeta, tabby, or ripstop is considered preferred, other weaves such as satins, twills, and the like also should be considered within the scope of the invention herein involved. A particularly preferred cloth for fabric member **12** is a 4 mil (0.10 mm) thick, 1.8 oz/yd^2 weight, silver-plated, woven nylon which is marketed commercially under the designation "31EN RIPSTOP" by Swift Textile Metalizing Corp., Bloomfield, Conn. However, depending upon the needs of the specific shielding application, a fabric constructed of a combination or blend of conductive and nonconductive fibers alternatively may be employed. Examples of fabrics woven, braided, or warp knitted from electrically-conductive fibers, or from blends of conductive and non-conductive fibers, are described in Gladfelter, U.S. Pat. No. 4,684,762, and in Buonanno, U.S. Pat. No. 4,857,668.

Returning to FIGS. **1** and **2**, coating member **14** preferably is formed from a curable layer of a fluent, flame retardant resin or other composition which is wet coated onto the second side **18** of fabric member **12**. As is detailed hereinafter, the viscosity and hydrodynamic pressure of the resin composition are controlled in accordance with the precepts of the present invention to delimit the penetration of the resin layer to a depth, referenced at "d" in FIG. **2**, which is less than the thickness dimension t_1 of the fabric member **12**. In this regard, when the layer is cured to form the flame retardant surface coating member **14** on the second side **18** of fabric member **12**, the first side **16** thereof remains electrically-conductive. In a preferred construction, the layer is coated to a wet thickness of about 10 mils (0.25 mm), and then cured to a dried coating or film thickness, referenced at t_2 in FIG. **2**, of between about 2–4 mils (0.05–0.10 mm) at a depth d of about 1–2 mils (0.025–0.05 mm). Ultimately, a total material thickness, referenced at "T," of between about 6–7 mils (0.15–0.20 mm) and a dried weight pickup of between about 100–150 g/yd^2 are observed. By "cured" it is meant that the resin is polymerized, cross-linked, further cross-linked or polymerized, vulcanized, hardened, dried, volatilized, or otherwise chemically or physically changed from a liquid or other fluent form into a solid polymeric or elastomeric phase.

The flame retardant composition preferably is formulated as an aqueous emulsion of an acrylic latex emulsion which is adjusted to a total solids of about 60% and a Brookfield viscosity (#5 spindle, 4 speed) of between about 40,000–60,000 cps, at a density of about 10 lbs per gallon (1.8 g/cm^3). Flame retardancy may be imparted by loading the emulsion

with between about 30–50% by weight of one or more conventional flame retardant additives such as aluminum hydrate, antimony trioxide, phosphate esters, or halogenated compounds such as polybrominated diphenyl oxides. A preferred formulation is a mixture of about 25% by weight, based on the total weight of the emulsion, of decambromodiphenyl oxide and about 15% by weight of one or more antimony compounds. In operation, should the acrylic carrier phase be ignited, the decomposition of the halogenated and metal oxide compounds function to chemically deprive the flame of sufficient oxygen to support combustion. The decomposition of the acrylic phase additionally may lead to the development of a protective, i.e., thermally-insulative or refractory, outer char layer.

A preferred flame retardant, acrylic latex emulsion is marketed commercially by Heveatex Corp., Fall River, Mass., under the designation "4129FR." The viscosity of the emulsion may be adjusted to between about 40,000–60,000 cps using an aqueous acryloid gel or other acrylic thickener. In this regard, the increased viscosity of the emulsion contributes to delimiting the penetration of the coating layer into the fabric member. However, as this relatively high viscosity may lead to undesirable porosity in the dried film, the emulsion additionally may be modified to reduce air entrapment and bubble formation in the coating layer with up to about 1% by weight of one or more commercial surfactants such as "Bubble Breaker" by Witco Chemical Corp. (Chicago, Ill.) and "Foam Master Antifoam" by Diamond Shamrock, Inc. (San Antonio, Tex.).

As aforementioned, EMI shielding material **10** of the present invention is particularly adapted for use as a flame retardant, electrically-conductive jacket which is provided over a foam core in an EMI shielding gasket construction such as gasket **50** of FIG. **4**. In a representative embodiment, gasket **50** includes an elongate, resilient foam core member, **52**, which may be of an indefinite length. Core member **52** has an outer circumferential surface, **54**, defining the cross-sectional profile of gasket **50** which, for illustrative purposes, is of a generally polygonal, i.e., square or rectangular geometry. Other plane profiles, such as circular, semi-circular, or elliptical, or complex profiles may be substituted, however, depending upon the geometry of the interface to be sealed. Core member **12** may be of any radial or diametric extent, but for most applications will have a diametric extent or width of from about 0.25 inch (0.64 cm) to 1 inch (2.54 cm).

For affording gap-filling capabilities, it is preferred that core member **52** is provided to be complaint over a wide range of temperatures, and to exhibit good compression-relaxation hysteresis even after repeated cyclings or long compressive dwells. Core member **52** therefore may be formed of a foamed elastomeric thermoplastic such as a polyethylene, polypropylene, polypropylene-EPDM blend, butadiene, styrene-butadiene, nitrile, chlorosulfonate, or a foamed neoprene, urethane, or silicone. Preferred materials of construction include open or closed cell urethanes or blends such as a polyolefin resin/monoolefin copolymer blend, or a neoprene, silicone, or nitrile sponge rubber.

Core member **52** may be provided as an extruded or molded foam profile over which shielding material **10** is wrapped as a sheathed, with the edges of sheathed being overlapped as at **56**. In a preferred construction, shielding material **10** is bonded to the core member **52** in a continuous molding process wherein the foam is blown or expanded within the shielding material. As may be seen best with reference to the magnified view of FIG. **4** referenced at **60** in FIG. **5**, in such construction coating member **14** is disposed adjacent core member **52** as an interior surface, **62**, of shielding member **10**, with the uncoated side **16** of fabric member **12** being oppositely disposed as an electrically-conductive exterior surface, **64**, of the gasket **50**. It will be appreciated that the coated interior surface **62** blocks the pores **22** (FIG. **3**) of the fabric member **12** of the fabric to retain the blown foam therein without penetrate or bleed through to the exterior gasket surface **64**. Depending upon the respective compositions of the foam and coating, the interior surface **62** may function, moreover, as a compatibilizing or "tie" interlayer which promotes the bonding of the foam to the fabric. Gasket construction **50** advantageously provides a structure that may be used in very low closure force, i.e. less than about 1 lb/inch (0.175 N/mm), applications.

Referring again to FIG. **4**, an adhesive layer, **70**, may be applied along the lengthwise extent of gasket **50** to the underside of exterior surface **64** for the attachment of the gasket to a substrate. Such layer **70** preferably is formulated to be of a pressure sensitive adhesive (PSA) variety. As is described in U.S. Pat. No. 4,988,550, suitable PSA's for EMI shielding applications include formulations based on silicones, neoprene, styrene butadiene copolymers, acrylics, acrylates, polyvinyl ethers, polyvinyl acetate copolymers, polyisobutylenes, and mixtures, blends, and copolymers thereof. Acrylic-based formulations, however, generally are considered to be preferred for the EMI applications of the type herein involved. Although PSA's are preferred for adhesive layer **70**, other adhesives such as epoxies and urethanes may be substituted and, accordingly, are to be considered within the scope of the present invention. Heat-fusible adhesives such a hot-melts and thermoplastic films additionally may find applicability.

Inasmuch as the bulk conductivity of gasket **50** is determined substantially through its surface contact with the substrate, an electrically-conductive PSA may be preferred to ensure optimal EMI shielding performance. Such adhesives conventionally are formulated as containing about 1–25% by weight of a conductive filler to yield a volume resistivity of from about 0.01–0.001 Ω-cm. The filler may be incorporated in the form of particles, fibers, flakes, microspheres, or microballoons, and may range in size of from about 1–100 microns. Typically filler materials include inherently conductive material such as metals, carbon, and graphite, or nonconductive materials such as plastic or glass having a plating of a conductive material such as a noble metal or the like. In this regard, the means by which the adhesive is rendered electrically conductive is not considered to be a critical aspect of the present invention, such that any means achieving the desired conductivity and adhesion are to be considered suitable.

For protecting the outer portion of adhesive layer **70** which is exposed on the exterior surface of the gasket, a release sheets, shown at **72**, may be provided as removably attached to the exposed adhesive. As is common in the adhesive art, release sheet **72** may be provided as strip of a waxed, siliconized, or other coated paper or plastic sheet or the like having a relatively low surface energy so as to be removable without appreciable lifting of the adhesive from the exterior surface **64**.

In the production of commercial quantities of the EMI shielding material **10** of the present invention, the viscosity adjusted and otherwise modified acrylic latex emulsion or other resin composition may be coated and cured on one side the fabric member **12** by a direct wet process such as knife over roll or slot die. With whatever process is employed, the hydrodynamic pressure of the resin composition is con-

trolled in accordance with the precepts of the present invention to delimit the penetration of the resin layer to a depth which is less than the thickness dimension of the fabric member. For example, and with reference to FIG. **6** wherein the head of a representative gravity-fed knife over roll coater is shown somewhat schematically at **100**, porous, i.e., permeable, fabric member **12** is conveyed from a feed roll or the like (not shown) over a nip roller, **102**, which rotates in the direction referenced by arrow **104**. With the first side **16** of fabric member **12** supported on roller **102**, the fabric second side **18** is passed beneath the opening, referenced at **106**, of a coating trough, **108**. Trough **108** is defined by a front plate, **110**, a back plate, **112**, and a pair of side plates (not shown).

The emulsion or other fluent resin composition, referenced at **114**, is pumped or otherwise transported into trough **108** which is filled to a fluid level, referenced at h. For a given fluid density, this level h is controlled such that the hydrodynamic pressure at the fabric-liquid interface is maintained within preset limits. For example, with a fluid density of about 10 pounds per gallon (1.8 g/cm^3), and a fabric having a porosity of about 1000–2000 openings per inch with a mean average pore size of between about 0.5–2 mils (12.5–50 μm), the fluid level H is controlled at about 4 inches (10 cm) to yield a hydrodynamic pressure of about 0.05 psi (0.35 kPa) at the fabric-liquid interface. For other coating processes, the hydrodynamic fluid pressure may be controlled, for example, by a pumping pressure or the like.

In the illustrative knife-over-roll coating process, the lower edge, **120**, of front plate **110** defines a knife surface which is shimmed or otherwise spaced-apart a predetermined distance from the second side **18** of fabric member **12**. Such spacing provides a clearance or gap, referenced at "g," of typically about 10 mils (0.25 mm), but which is adjustable to regulate the thickness of the liquid coating layer, **122**, being applied to the fabric member. From roller **104**, the coated fabric member **12** may be conveyed via a take-up roller arrangement (not shown) through a in-line oven or the like to dry or flash the water or other diluent in the liquid coating layer **122**, or to otherwise cure the liquid coating layer **122** in developing an adherent, tack-free, film or other layer of coating member **14** (FIG. **1**) on the single side **18** of fabric member **12**.

The Example to follow, wherein all percentages and proportions are by weight unless otherwise expressly indicated, is illustrative of the practicing of the invention herein involved, but should not be construed in any limiting sense.

EXAMPLE

Representative EMI shielding materials according to the present invention were constructed for characterization. In this regard, a master batch of a flame retardant coating composition was compounded using an acrylic latex emulsion (Heveatex "4129FR"). The viscosity of the emulsion was adjusted to a Brookfield viscosity (#4 spindle, 40 speed) of about 60,000 cps with about 5 wt % of an acryloid thickener (Acrysol™ GS, Monsanto Co., St. Louis, Mo.). The modified emulsion had a total solids content of about 60% by weight, a density of about 10 pounds per gallon (1.8 g/cm^3), and a pH of between about 7.5 and 9.5.

The emulsion was applied using a knife over roll coater (JETZONE Model 7319, Wolverine Corp., Merrimac, Mass.) to one side of a silver-plated nylon fabric (Swift "31EN RIPSTOP") having a thickness of about 4 mils (0.1 mm). With the fluid level in the coating trough of the coater maintained at about 4 inch (10 cm), the emulsion was delivered to the surface of the cloth at a hydrodynamic pressure of about 0.05 psi (0.35 kPa). The coating knife was shimmed to a 10 mil (0.25 mm) gap above the fabric to yield a wet coating draw down thickness of about 10 mils. Following an oven curing at 100–125° C. for 5 minutes, a dried coating or film thickness of about 2.5 mils (0.635 mm) was obtained with a weight pickup of about 130–145 g/yd^2 and a total material thickness of between about 6–7 mils (0.15–0.18 mm). An inspection of the coated fabric cloth revealed a coating penetration depth of about 1–2 mils (0.02–0.05 mm) providing acceptable mechanical retention and/or adhesion of the coating onto the fabric surface. The opposite side of the fabric, however, was observed to be substantially coating free, and to retain a surface resistivity of about 0.1 Ω/sq for unaffected EMI shielding effectiveness.

Fabric samples similarly coated in the manner described were subjected to an in-house vertical flame test. No burning was observed at dried film thickness of 2, 3, or 4 mils (0.05, 0.08, 0.10 mm). Accordingly, a reasonable operating window of film thickness was suggested for production runs.

Samples also were provided, as jacketed over a polyurethane foam core in an EMI shielding gasket construction, for flame testing by Underwriters Laboratories, Inc., Melville, N.Y. A flame class rating of V-0 under UL94 was assigned at a minimum thickness of 1.0 mm. The gasket construction therefore was found to be compliant with the applicable UL requirements, and was approved to bear the "UL" certification mark.

The foregoing results confirm that, the EMI shielding material of the present invention affords UL94 V-0 protection when used as a jacketing in a fabric-over-foam gasket construction. Unexpectedly, it was found that a relatively porous or permeable fabric may be wet coated on one side with a relatively thin, i.e., 2–4 mil (0.05–0.10 mm), coating layer of a flame retardant composition without compromising the electrical surface conductivity of the other side. Such a thin coating layer, while being sufficient to provide UL94 V-0 protection in a conventional fabric-over-foam gasket construction, nonetheless maintains the drapability the fabric and thereby facilitates the fabrication of UL94 V-0 compliant gaskets having complex profiles or narrow cross-sections down to about 1 mm.

As it is anticipated that certain changes may be made in the present invention without departing from the precepts herein involved, it is intended that all matter contained in the foregoing description shall be interpreted as illustrative and not in a limiting sense. All references cited herein are expressly incorporated by reference.

What is claimed is:

1. A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer comprising at least about 30% by weight of one or more flame retardant additives and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

2. The gasket of claim 1 wherein said flame retardant layer has a thickness of between about 2–4 mils (0.05–0.10 mm).

3. The gasket of claim 1 wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion.

4. The gasket of claim 1 wherein said fabric member is a metal-plated cloth.

5. The gasket of claim 4 wherein said cloth comprises fibers selected from the group consisting of cotton, wool, silk, cellulose, polyester, polyamide, nylon, and combinations thereof, and said metal is selected from the group consisting of copper, nickel, silver, nickel-plated-silver, aluminum, tin, and combinations thereof.

6. The gasket of claim 1 wherein said foamed elastomeric material is selected from the group consisting of polyethylenes, polypropylenes, polypropylene-EPDM blends, butadienes, styrene-butadienes, nitriles, chlorosulfonates, neoprenes, urethanes, silicones, and polyolefin resin/monoolefin copolymer blends, and combinations thereof.

7. The gasket of claim 1 wherein said fabric member has a thickness of between about 2–4 mils (0.05–0.10 mm).

8. The gasket of claim 1 wherein said flame retardant layer is effective to afford the gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

9. The gasket of claim 1 wherein said one or more flame retardant additives are selected from the group consisting of aluminum hydrate, antimony trioxide, phosphate esters, and halogenated compounds.

* * * * *

EXHIBIT C

US006777095B2

(12) **United States Patent**
Bunyan et al.

(10) **Patent No.: US 6,777,095 B2**
(45) **Date of Patent: Aug. 17, 2004**

(54) **FLAME RETARDANT EMI SHIELDING GASKET**

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(73) Assignee: **Parker-Hannifin Corporation**, Cleveland, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/753,016**

(22) Filed: **Jan. 7, 2004**

(65) **Prior Publication Data**

US 2004/0142616 A1 Jul. 22, 2004

Related U.S. Application Data

(63) Continuation of application No. 10/318,609, filed on Dec. 11, 2002, now Pat. No. 6,716,536, which is a continuation of application No. 10/142,803, filed on May 9, 2002, now Pat. No. 6,521,348, which is a continuation of application No. 09/883,785, filed on Jun. 18, 2001, now Pat. No. 6,387,523, which is a continuation of application No. 09/250,338, filed on Feb. 16, 1999, now Pat. No. 6,248,393.

(60) Provisional application No. 60/076,370, filed on Feb. 27, 1998.

(51) **Int. Cl.**[7] **B32B 5/14**; B32B 5/18; H05K 9/00

(52) **U.S. Cl.** **428/457**; 361/818

(58) **Field of Search** 428/457; 361/818

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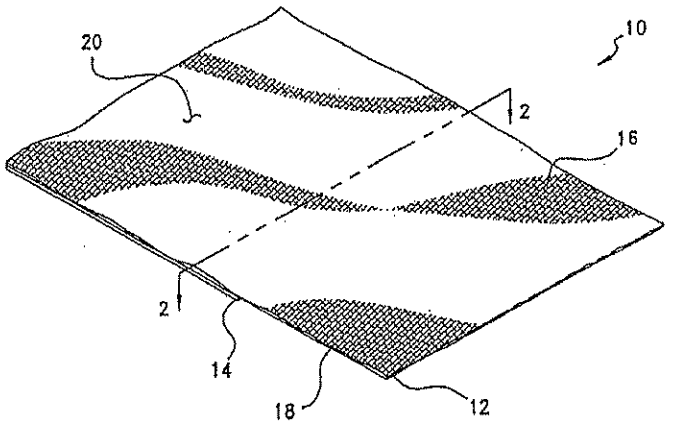
Primary Examiner—Erma Cameron
(74) *Attorney, Agent, or Firm*—John A. Molnar, Jr.

(57) **ABSTRACT**

A flame retardant, electromagnetic interference (EMI) shielding gasket construction. The construction includes a resilient core member formed of a foamed elastomeric material, an electrically-conductive fabric member surrounding the outer surface of the core member, and a flame retardant layer coating at least a portion of the interior surface of the fabric member. The flame retardant layer is effective to afford the gasket construction with a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

10 Claims, 3 Drawing Sheets



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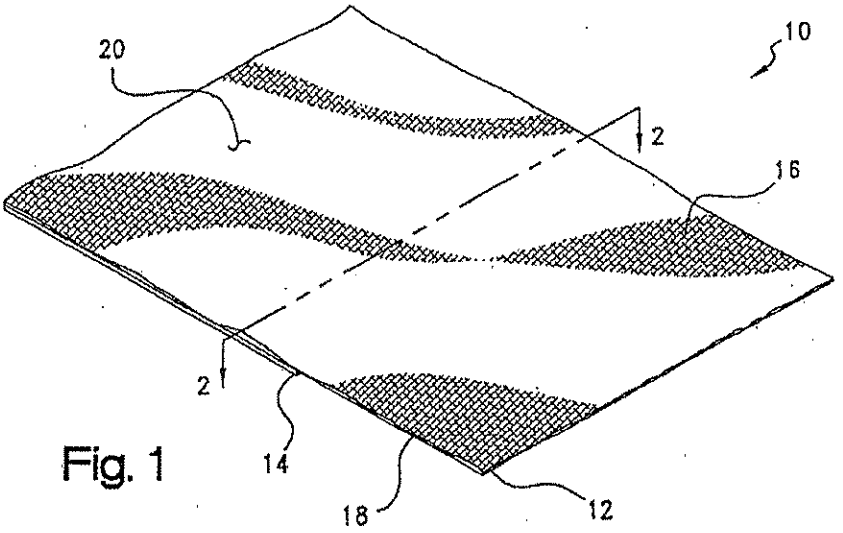

Fig. 1

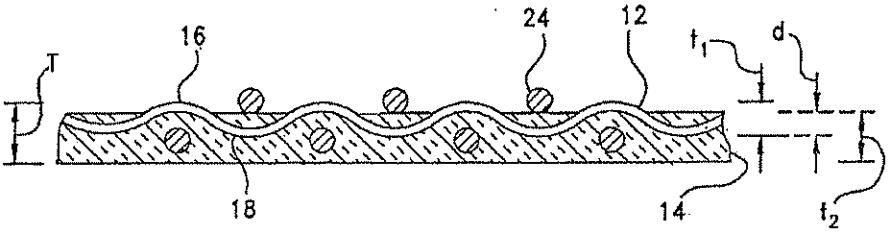

Fig. 2

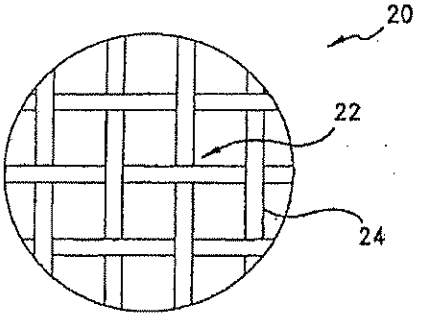

Fig. 3

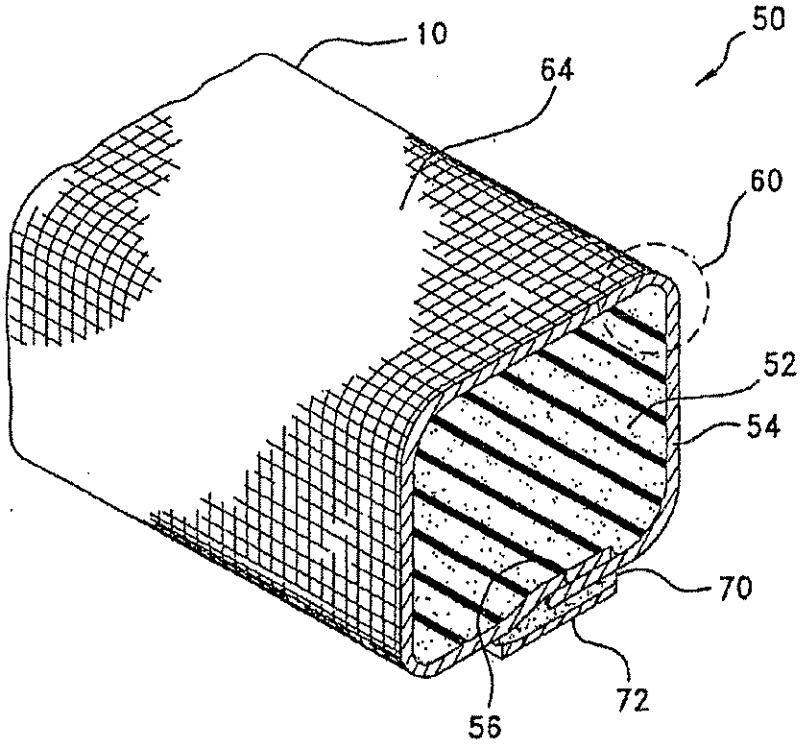

Fig. 4

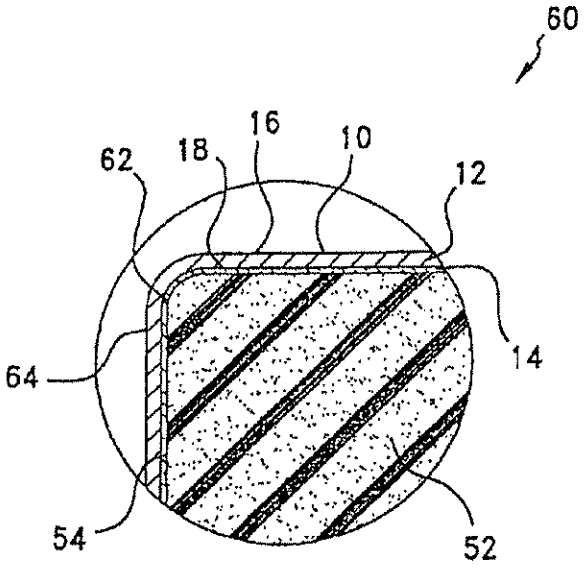

Fig. 5

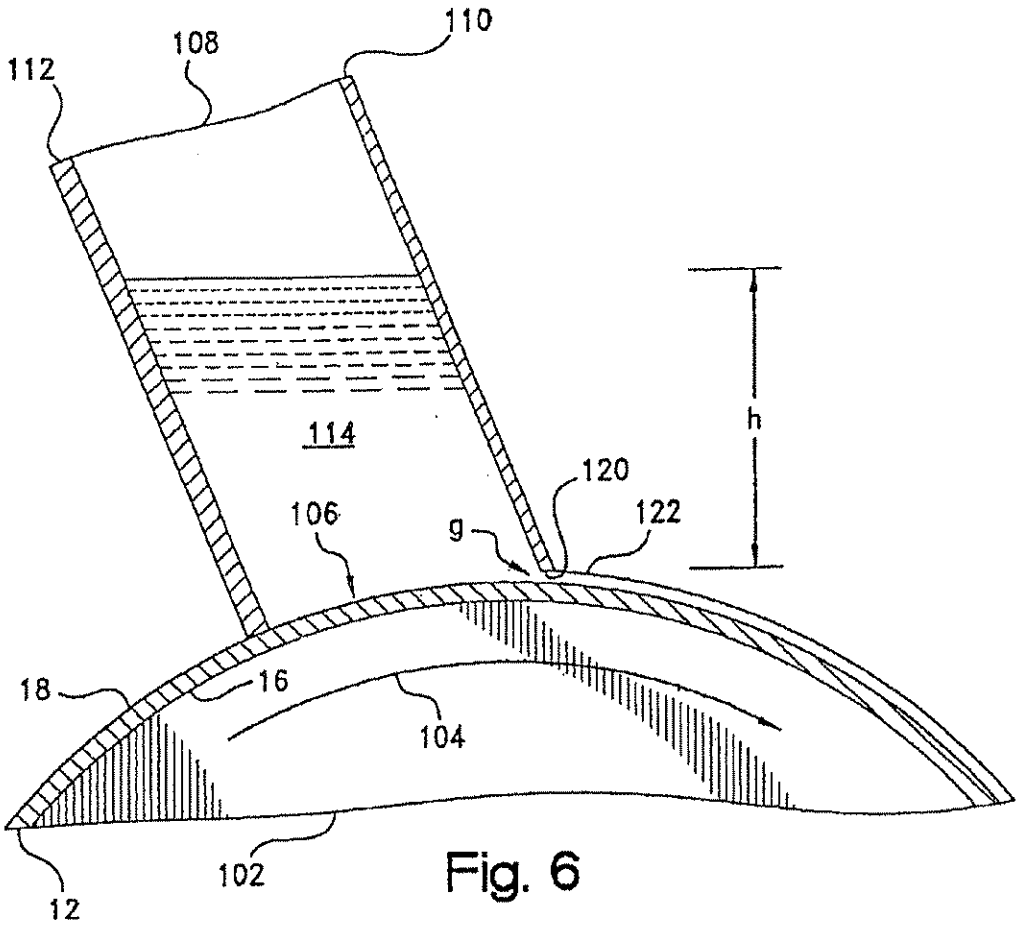

Fig. 6

FLAME RETARDANT EMI SHIELDING GASKET

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 10/318,609, filed Dec. 11, 2002, now U.S. Pat. No. 6,716,536; which is a continuation of U.S. application Ser. No. 10/142,803, filed May 9, 2002, now U.S. Pat. No. 6,521,348; which is a continuation of U.S. application Ser. No. 09/883,785, filed Jun. 18, 2001, now U.S. Pat. No. 6,387,523; which is a continuation of U.S. application Ser. No. 09/250,338, filed Feb. 16, 1999, now U.S. Pat. No. 6,248,393 and claiming priority to U.S. Provisional application Serial No. 60/076,370, filed Feb. 27, 1998, the disclosure of each of which is expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates broadly to electrically-conductive, flame retardant materials for use in electromagnetic interference (EMI) shielding, and to a method of manufacturing the same, and more particularly to an electrically-conductive fabric having a layer of a flame retardant coating applied to one surface thereof for use as a sheathing within an EMI shielding gasket.

The operation of electronic devices including televisions, radios, computers, medical instruments, business machines, communications equipment, and the like is attended by the generation of electromagnetic radiation within the electronic circuitry of the equipment. Such radiation often develops as a field or as transients within the radio frequency band of the electromagnetic spectrum, i.e., between about 10 KHz and 10 GHz, and is termed "electromagnetic interference" or "EMI" as being known to interfere with the operation of other proximate electronic devices.

To attenuate EMI effects, shielding having the capability of absorbing and/or reflecting EMI energy may be employed both to confine the EMI energy within a source device, and to insulate that device or other "target" devices from other source devices. Such shielding is provided as a barrier which is inserted between the source and the other devices, and typically is configured as an electrically conductive and grounded housing which encloses the device. As the circuitry of the device generally must remain accessible for servicing or the like, most housings are provided with openable or removable accesses such as doors, hatches, panels, or covers. Between even the flattest of these accesses and its corresponding mating or faying surface, however, there may be present gaps which reduce the efficiency of the shielding by presenting openings through which radiant energy may leak or otherwise pass into or out of the device. Moreover, such gaps represent discontinuities in the surface and ground conductivity of the housing or other shielding, and may even generate a secondary source of EMI radiation by functioning as a form of slot antenna. In this regard, bulk or surface currents induced within the housing develop voltage gradients across any interface gaps in the shielding, which gaps thereby function as antennas which radiate EMI noise. In general, the amplitude of the noise is proportional to the gap length, with the width of the gap having a less appreciable effect.

For filling gaps within mating surfaces of housings and other EMI shielding structures, gaskets and other seals have been proposed both for maintaining electrical continuity across the structure, and for excluding from the interior of the device such contaminates as moisture and dust. Such seals are bonded or mechanically attached to, or press-fit into, one of the mating surfaces, and function to close any interface gaps to establish a continuous conductive path thereacross by conforming under an applied pressure to irregularities between the surfaces. Accordingly, seals intended for EMI shielding applications are specified to be of a construction which not only provides electrical surface conductivity even while under compression, but which also has a resiliency allowing the seals to conform to the size of the gap. The seals additionally must be wear resistant, economical to manufacture, and capability of withstanding repeated compression and relaxation cycles. For further information on specifications for EMI shielding gaskets, reference may be had to Severinsen, J., "Gaskets That Block EMI," Machine Design, Vol. 47, No. 19, pp. 74–77 (Aug. 7, 1975).

Requirements for typical EMI shielding applications often dictate a low impedance, low profile gasket which is deflectable under normal closure force loads. Other requirements include low cost and a design which provides an EMI shielding effectiveness for both the proper operation of the device and compliance, in the United States, with commercial Federal Communication Commission (FCC) EMC regulations.

A particularly economical gasket construction, which also requires very low closure forces, i.e. less than about 1 lb/inch (0.175 N/mm), is marketed by the Chomerics Division of Parker-Hannifin Corp., Woburn, Mass. under the tradenarne "Soft-Shield ® 5000 Series." Such construction consists of an electrically-conductive jacket or sheathing which is "cigarette" wrapped lengthwise over a polyurethane or other foam core. As is described further in U.S. Pat. No. 4,871,477, polyurethane foams generally are produced by the reaction of polyisocyanate and a hydroxyl-functional polyol in the presence of a blowing agent. The blowing agent effects the expansion of the polymer structure into a multiplicity of open or closed cells.

The jacket is provided as a highly conductive, i.e., about 1 Ω-sq., nickel-plated-silver, woven rip-stop nylon which is self-terminating when cut. Advantageously, the jacket may be bonded to the core in a continuous molding process wherein the foam is blown or expanded within the jacket as the jacket is wrapped around the expanding foam and the foam and jacket are passed through a die and into a traveling molding. Similar gasket constructions are shown in commonly-assigned U.S. Pat. No. 5,028,739 and in U.S. Pat. Nos. 4,857,668; 5,054,635; 5,105,056; and 5,202,536.

Many electronic devices, including PC's and communication equipment, must not only comply with certain FCC requirements, but also must meet be approved under certain Underwriter's Laboratories (UL) standards for flame retardancy. In this regard, if each of the individual components within an electronic device is UL approved, then the device itself does not require separate approval. Ensuring UL approval for each component therefore reduces the cost of compliance for the manufacturer, and ultimately may result in cheaper goods for the consumer. For EMI shielding gaskets, however, such gaskets must be made flame retardant, i.e., achieving a rating of V-0 under UL Std. No. 94, "Tests for Flammability of Plastic Materials for Parts in Devices and Appliances" (1991), without compromising the electrical conductivity necessary for meeting EMI shielding requirements.

In this regard, and particularly with respect to EMI shielding gaskets of the above-described fabric over foam

variety, it has long been recognized that foamed polymeric materials are flammable and, in certain circumstances, may present a fire hazard. Owing to their cellular structure, high organic content, and surface area, most foam materials are subject to relatively rapid decomposition upon exposure to fire or high temperatures.

One approach for imparting flame retardancy to fabric over foam gaskets has been to employ the sheathing as a flame resistant protective layer for the foam. Indeed, V-0 rating compliance purportedly has been achieved by sheathing the foam within an electrically-conductive Ni/Cu-plated fabric to which a thermoplastic sheet is hot nipped or otherwise fusion bonding to the underside thereof. Such fabrics, which may be further described in one or more of U.S. Pat. Nos. 4,489,126; 4,531,994; 4,608,104; and/or 4,621,013, have been marketed by Monsanto Co., St. Louis, under the tradename "Flectron® Ni/Cu Polyester Taffeta V0."

Other fabric over foam gaskets, as is detailed in U.S. Pat. No. 4,857,668, incorporate a supplemental layer or coating applied to the interior surface of the sheath. Such coating may be a flame-retardant urethane formulation which also promotes the adhesion of the sheath to the foam. The coating additionally may function to reduce bleeding of the foam through the fabric which otherwise could compromise the electrical conductivity of the sheath.

In view of the foregoing, it will be appreciated that further improvements in the design of flame retardant, fabric-over foam EMI shielding gaskets, as well as sheathing materials therefore, would be well-received by the electronics industry. Especially desired would be a flame retardant gasket construction which achieves a UL94 rating of V-0.

BROAD STATEMENT OF THE INVENTION

The present invention is directed to an electrically-conductive, flame retardant material for use in fabric-over-foam EMI shielding gaskets, and to a method of manufacturing the same. In having a layer of a flame retardant coating applied to one side of an electrically-conductive, generally porous fabric, the material of the invention affords UL94 V-0 protection when used as a jacketing in a fabric-over-foam gasket construction. Advantageously, as the flame retardant layer may be wet coated on the fabric without appreciable bleed through, a relatively thin, i.e., 2–4 mil (0.05–0.10 mm), coating layer may be provided on one fabric side without compromising the electrical surface conductivity of the other side. Such a thin coating layer, while being sufficient to provide UL94 V-0 protection, nonetheless maintains the drapability the fabric and thereby facilitates the construction UL94 V-0 compliant gaskets having complex profiles or narrow cross-sections down to about 1 mm.

In a preferred embodiment, the electrically-conductive, flame retardant EMI shielding material of the invention includes a nickel or silver-plated, woven nylon, polyester, or like fabric on one side of which is wet coated a layer of a flame retardant, acrylic latex emulsion or other fluent resin composition. In accordance with the precepts of the method of the invention, the viscosity and hydrodynamic pressure of the emulsion are controlled such that the coating does not penetrate or otherwise "bleed through" the uncoated side of the fabric. The surface conductivity of the opposite side of the fabric therefore is not compromised in EMI shielding applications.

The material of the invention may be employed as a jacket in fabric-over-foam EMI shielding gasket constructions, and is particularly adapted for use in the continuous molding process for such gaskets. As used within such process, the fabric may be wrapped around the foam as a jacket with coated side thereof being disposed as an interior surface adjacent the foam, and the uncoated side being disposed as an electrically-conductive exterior surface. Advantageously, the coating on the interior surface of the jacket blocks the pores of the fabric to retain the foam therein without penetrate or bleed through to the exterior surface. In being formed of a acrylic material, the coated interior surface of the jacket may function, moreover, depending upon the composition of the foam, as a compatibilizing or "tie" interlayer which promotes the bonding of the foam to the fabric.

The present invention, accordingly, comprises material and method possessing the construction, combination of elements, and arrangement of parts and steps which are exemplified in the detailed disclosure to follow. Advantages of the present invention include a flame retardant yet drapable EMI shielding fabric. Additional advantages include an economical, flame retardant EMI shielding fabric construction wherein a relatively thin layer of a flame retardant coating may be wet coated onto one side of an electrically-conductive, woven or other generally porous EMI shielding fabric without compromising the conductivity of the other side of the fabric. These and other advantages will be readily apparent to those skilled in the art based upon the disclosure contained herein.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

FIG. **1** is a perspective view of one embodiment of an EMI shielding material according to the present invention which material includes a generally planar fabric member on one side of which is coated a layer of a flame retardant composition, the view being shown with portions being broken away to better reveal the structure of the material;

FIG. **2** is an enlarged cross-sectional view of the EMI shielding material of FIG. **1** taken through plane represented by line **2**—**2** of FIG. **1**;

FIG. **3** is a top view of the material of FIG. **1** which is magnified to reveal the structure of the fabric member thereof;

FIG. **4** is a perspective cross-sectional view of a length of a representative EMI shielding gasket construction according to the present invention including a jacket which is formed of the EMI shielding material of FIG. **1**;

FIG. **5** is an end view of the gasket of FIG. **4** which is magnified to reveal the structure thereof; and

FIG. **6** is a schematic, partially cross-sectional view of an illustrative gravity-fed, knife over roll coater as adapted for use in the manufacture of the EMI shielding material of FIG. **1**.

The drawings will be described further in connection with the following Detailed Description of the Invention.

DETAILED DESCRIPTION OF THE INVENTION

Certain terminology may be employed in the description to follow for convenience rather than for any limiting purpose. For example, the terms "upper" and "lower" designate directions in the drawings to which reference is made,

with the terms "inner" or "interior" and "outer" or "exterior" referring, respectively, to directions toward and away from the center of the referenced element, and the terms "radial" and "axial" referring, respectively, to directions perpendicular and parallel to the longitudinal central axis of the referenced element. Terminology of similar import other than the words specifically mentioned above likewise is to be considered as being used for purposes of convenience rather than in any limiting sense.

For the illustrative purposes of the discourse to follow, the electromagnetic interference (EMI) shielding material herein involved is described in connection with its use as a flame retardant, electrically-conductive jacket for a foam core, EMI shielding gasket as may be adapted to be received within an interface, such as between a door, panel, hatch, cover, or other parting line of an electromagnetic interference (EM) shielding structure. The EMI shielding structure may be the conductive housing of a computer, communications equipment, or other electronic device or equipment which generates EMI radiation or is susceptible to the effects thereof. The gasket may be bonded or fastened to, or press-fit into one of a pair of mating surfaces which define the interface within the housing, and functions between the mating surfaces to seal any interface gaps or other irregularities. That is, while under an applied pressure, the gasket resiliently conforms to any such irregularities both to establish a continuous conductive path across the interface, and to environmentally seal the interior of the housing against the ingress of dust, moisture, or other contaminates. It will be appreciated, however, that aspects of the present invention may find utility in other EMI shielding applications. Use within those such other applications therefore should be considered to be expressly within the scope of the present invention.

Referring then to the figures, wherein corresponding reference characters are used to designate corresponding elements throughout the several views, a flame retardant EMI shielding material according to the present invention is shown generally at **10** in FIG. **1** as generally adapted for use as a jacket within for a foam core gasket construction. For purposes of illustration, material sheet **10** is shown to be of indefinite dimensions which may be cut to size for the particular application envisioned. In basic construction, material **10** includes an upper, generally planar and porous fabric member, **12**, and a lower, flame retardant coating member, **14**.

Fabric member has at least an electrically-conductive first side, **16**, and a conductive or non-conductive second side, **18**, defining a thickness dimension, referenced at "t_1" in the cross-sectional view of FIG. **2**, which may vary from about 2–4 mils (0.05–0.10 mm). By "electrically-conductive," it is meant that the fabric may be rendered conductive, i.e., to a surface resistivity of about 0.1 Ω/sq. or less, by reason of its being constructed of electrically-conductive wire, monofilaments, yams or other fibers or, alternatively, by reason of a treatment such as a plating or sputtering being applied to non-conductive fibers to provide an electrically-conductive layer thereon. Preferred electrically-conductive fibers include Monel nickel-copper alloy, silver-plated copper, nickel-clad copper, Ferrex® tin-plated copper-clad steel, aluminum, tin-clad copper, phosphor bronze, carbon, graphite, and conductive polymers. Preferred non-conductive fibers include cotton, wool, silk, cellulose, polyester, polyanide, nylon, and polyimide monofilaments or yarns which are rendered electrically conductive with a metal plating of copper, nickel, silver, nickel-plated-silver, aluminum, tin, or an alloy thereof. As is known, the metal plating may applied to individual fiber strands or to the surfaces of the fabric after weaving, knitting, or other fabrication.

While fabrics such as wire meshes, knits, and non-woven cloths and webs may find application, a preferred fabric construction for member **12** is a plain weave nylon or polyester cloth which is made electrically conductive with between about 20–40% by weight based on the total fabric weight, i.e., 0.01–0.10 g/in^2, of a silver, nickel-silver, or silver-nickel over copper plating. As may be seen in the magnified view of FIG. **1** referenced at **20** in FIG. **3**, such cloth is permeable in having a plain, generally square weave pattern with pores or openings, one of which is referenced at **22**, being defined between the fibers which are represented schematically at **24**. Fibers **24** may be yarns, monofilaments or, preferably, bundles of from about 10–20 filaments or threads, each having a diameter of between about 10–50 μm. For example, with fibers **24** each being a bundle of such threads with a thread count of between about 1000–3000 per inch and a weave count of between about 1000–1500 per inch, 1000–2000 openings per inch will be defined with a mean average pore size of between about 0.5–2 mils (12.5–50 μm).

Although a plain, square weave pattern such as a taffeta, tabby, or ripstop is considered preferred, other weaves such as satins, twills, and the like also should be considered within the scope of the invention herein involved. A particularly preferred cloth for fabric member **12** is a 4 mil (0.10 mm) thick, 1.8 oz/yd^2 weight, silver-plated, woven nylon which is marketed commercially under the designation "31EN RIPSTOP" by Swift Textile Metalizing Corp., Bloomfield, Conn. However, depending upon the needs of the specific shielding application, a fabric constructed of a combination or blend of conductive and nonconductive fibers alternatively may be employed. Examples of fabrics woven, braided, or warp knitted from electrically-conductive fibers, or from blends of conductive and non-conductive fibers, are described in Gladfelter, U.S. Pat. No. 4,684,762, and in Buonanno, U.S. Pat. No. 4,857,668.

Returning to FIGS. **1** and **2**, coating member **14** preferably is formed from a curable layer of a fluent, flame retardant resin or other composition which is wet coated onto the second side **18** of fabric member **12**. As is detailed hereinafter, the viscosity and hydrodynamic pressure of the resin composition are controlled in accordance with the precepts of the present invention to delimit the penetration of the resin layer to a depth, referenced at "d" in FIG. **2**, which is less than the thickness dimension t_1 of the fabric member **12**. In this regard, when the layer is cured to form the flame retardant surface coating member **14** on the second side **18** of fabric member **12**, the first side **16** thereof remains electrically-conductive. In a preferred construction, the layer is coated to a wet thickness of about 10 mils (0.25 mm), and then cured to a dried coating or film thickness, referenced at t_2 in FIG. **2**, of between about 2–4 mils (0.05–0.10 mm) at a depth d of about 1–2 mils (0.025–0.05 mm). Ultimately, a total material thickness, referenced at "T," of between about 6–7 mils (0.15–0.20 mm) and a dried weight pickup of between about 100–150 g/yd^2 are observed. By "cured" it is meant that the resin is polymerized, cross-linked, further cross-linked or polymerized, vulcanized, hardened, dried, volatilized, or otherwise chemically or physically changed from a liquid or other fluent form into a solid polymeric or elastomeric phase.

The flame retardant composition preferably is formulated as an aqueous emulsion of an acrylic latex emulsion which is adjusted to a total solids of about 60% and a Brookfield

viscosity (#5 spindle, 4 speed) of between about 40,000–60,000 cps, at a density of about 10 lbs per gallon (1.8 g/cm^3). Flame retardancy may be imparted by loading the emulsion with between about 30–50% by weight of one or more conventional flame retardant additives such as aluminum hydrate, antimony trioxide, phosphate esters, or halogenated compounds such as polybrominated diphenyl oxides. A preferred formulation is a mixture of about 25% by weight, based on the total weight of the emulsion, of decambromodiphenyl oxide and about 15% by weight of one or more antimony compounds. In operation, should the acrylic carrier phase be ignited, the decomposition of the halogenated and metal oxide compounds function to chemically deprive the flame of sufficient oxygen to support combustion. The decomposition of the acrylic phase additionally may lead to the development of a protective, i.e., thermally-insulative or refractory, outer char layer.

A preferred flame retardant, acrylic latex emulsion is marketed commercially by Heveatex Corp., Fall River, Mass., under the designation "4129FR." The viscosity of the emulsion may be adjusted to between about 40,000–60,000 cps using an aqueous acryloid get or other acrylic thickener. In this regard, the increased viscosity of the emulsion contributes to delimiting the penetration of the coating layer into the fabric member. However, as this relatively high viscosity may lead to undesirable porosity in the dried film, the emulsion additionally may be modified to reduce air entrapment and bubble formation in the coating layer with up to about 1% by weight of one or more commercial surfactants such as "Bubble Breaker" by Witco Chemical Corp. (Chicago, Ill.) and "Foam Master Antifoam" by Diamond Shamrock, Inc. (San Antonio, Tex.).

As aforementioned, EMI shielding material **10** of the present invention is particularly adapted for use as a flame retardant, electrically-conductive jacket which is provided over a foam core in an EMI shielding gasket construction such as gasket **50** of FIG. **4**. In a representative embodiment, gasket **50** includes an elongate, resilient foam core member, **52**, which may be of an indefinite length. Core member **52** has an outer circumferential surface, **54**, defining the cross-sectional profile of gasket **50** which, for illustrative purposes, is of a generally polygonal, i.e., square or rectangular geometry. Other plane profiles, such as circular, semi-circular, or elliptical, or complex profiles may be substituted, however, depending upon the geometry of the interface to be sealed. Core member **12** may be of any radial or diametric extent, but for most applications will have a diametric extent or width of from about 0.25 inch (0.64 cm) to 1 inch (2.54 cm).

For affording gap-filling capabilities, it is preferred that core member **52** is provided to be complaint over a wide range of temperatures, and to exhibit good compression-relaxation hysteresis even after repeated cyclings or long compressive dwells. Core member **52** therefore may be formed of a foamed elastomeric thermoplastic such as a polyethylene, polypropylene, polypropylene-EPDM blend, butadiene, styrene-butadiene, nitrile, chlorosulfonate, or a foamed neoprene, urethane, or silicone. Preferred materials of construction include open or closed cell urethanes or blends such as a polyolefin resin/monoolefin copolymer blend, or a neoprene, silicone, or nitrile sponge rubber.

Core member **52** may be provided as an extruded or molded foam profile over which shielding material **10** is wrapped as a sheathed, with the edges of sheathed being overlapped as at **56**. In a preferred construction, shielding material **10** is bonded to the core member **52** in a continuous molding process wherein the foam is blown or expanded within the shielding material. As may be seen best with reference to the magnified view of FIG. **4** referenced at **60** in FIG. **5**, in such construction coating member **14** is disposed adjacent core member **52** as an interior surface, **62**, of shielding member **10**, with the uncoated side **16** of fabric member **12** being oppositely disposed as an electrically-conductive exterior surface, **64**, of the gasket **50**. It will be appreciated that the coated interior surface **62** blocks the pores **22** (FIG. **3**) of the fabric member **12** of the fabric to retain the blown foam therein without penetrate or bleed through to the exterior gasket surface **64**. Depending upon the respective compositions of the foam and coating, the interior surface **62** may function, moreover, as a compatibilizing or "tie" interlayer which promotes the bonding of the foam to the fabric. Gasket construction **50** advantageously provides a structure that may be used in very low closure force, i.e. less than about 1 lb/inch (0.175 N/mm), applications.

Referring again to FIG. **4**, an adhesive layer, **70**, may be applied along the lengthwise extent of gasket **50** to the underside of exterior surface **64** for the attachment of the gasket to a substrate. Such layer **70** preferably is formulated to be of a pressure sensitive adhesive (PSA) variety. As is described in U.S. Pat. No. 4,988,550, suitable PSA's for EMI shielding applications include formulations based on silicones, neoprene, styrene butadiene copolymers, acrylics, acrylates, polyvinyl ethers, polyvinyl acetate copolymers, polyisobutylenes, and mixtures, blends, and copolymers thereof. Acrylic-based formulations, however, generally are considered to be preferred for the EMI applications of the type herein involved. Although PSA's are preferred for adhesive layer **70**, other adhesives such as epoxies and urethanes may be substituted and, accordingly, are to be considered within the scope of the present invention. Heat-fusible adhesives such a hot-melts and thermoplastic films additionally may find applicability.

Inasmuch as the bulk conductivity of gasket **50** is determined substantially through its surface contact with the substrate, an electrically-conductive PSA may be preferred to ensure optimal EMI shielding performance. Such adhesives conventionally are formulated as containing about 1–25% by weight of a conductive filler to yield a volume resistivity of from about 0.01–0.001 Ω-cm. The filler may be incorporated in the form of particles, fibers, flakes, microspheres, or microballoons, and may range in size of from about 1–100 microns. Typically filler materials include inherently conductive material such as metals, carbon, and graphite, or nonconductive materials such as plastic or glass having a plating of a conductive material such as a noble metal or the like. In this regard, the means by which the adhesive is rendered electrically conductive is not considered to be a critical aspect of the present invention, such that any means achieving the desired conductivity and adhesion are to be considered suitable.

For protecting the outer portion of adhesive layer **70** which is exposed on the exterior surface of the gasket, a release sheets, shown at **72**, may be provided as removably attached to the exposed adhesive. As is common in the adhesive art, release sheet **72** may be provided as strip of a waxed, siliconized, or other coated paper or plastic sheet or the like having a relatively low surface energy so as to be removable without appreciable lifting of the adhesive from the exterior surface **64**.

In the production of commercial quantities of the EMI shielding material **10** of the present invention, the viscosity adjusted and otherwise modified acrylic latex emulsion or other resin composition may be coated and cured on one side

the fabric member **12** by a direct wet process such as knife over roll or slot die. With whatever process is employed, the hydrodynamic pressure of the resin composition is controlled in accordance with the precepts of the present invention to delimit the penetration of the resin layer to a depth which is less than the thickness dimension of the fabric member. For example, and with reference to FIG. **6** wherein the head of a representative gravity-fed knife over roll coater is shown somewhat schematically at **100**, porous, i.e., permeable, fabric member **12** is conveyed from a feed roll or the like (not shown) over a nip roller, **102**, which rotates in the direction referenced by arrow **104**. With the first side **16** of fabric member **12** supported on roller **102**, the fabric second side **18** is passed beneath the opening, referenced at **106**, of a coating trough, **108**. Trough **108** is defined by a front plate, **10**, a back plate, **112**, and a pair of side plates (not shown).

The emulsion or other fluent resin composition, referenced at **114**, is pumped or otherwise transported into trough **108** which is filled to a fluid level, referenced at h. For a given fluid density, this level h is controlled such that the hydrodynamic pressure at the fabric-liquid interface is maintained within preset limits. For example, with a fluid density of about 10 pounds per gallon (1.8 g/cm^3), and a fabric having a porosity of about 1000–2000 openings per inch with a mean average pore size of between about 0.5–2 mils (12.5–50 μm), the fluid level H is controlled at about 4 inches (10 cm) to yield a hydrodynamic pressure of about 0.05 psi (0.35 kPa) at the fabric-liquid interface. For other coating processes, the hydrodynamic fluid pressure may be controlled, for example, by a pumping pressure or the like.

In the illustrative knife-over-roll coating process, the lower edge, **120**, of front plate **110** defines a knife surface which is shimmed or otherwise spaced-apart a predetermined distance from the second side **18** of fabric member **12**. Such spacing provides a clearance or gap, referenced at "g," of typically about 10 mils (0.25 mm), but which is adjustable to regulate the thickness of the liquid coating layer, **122**, being applied to the fabric member. From roller **104**, the coated fabric member **12** may be conveyed via a take-up roller arrangement (not shown) through a in-line oven or the like to dry or flash the water or other diluent in the liquid coating layer **122**, or to otherwise cure the liquid coating layer **122** in developing an adherent, tack-free, film or other layer of coating member **14** (FIG. **1**) on the single side **18** of fabric member **12**.

The Example to follow, wherein all percentages and proportions are by weight unless otherwise expressly indicated, is illustrative of the practicing of the invention herein involved, but should not be construed in any limiting sense.

EXAMPLE

Representative EMI shielding materials according to the present invention were constructed for characterization. In this regard, a master batch of a flame retardant coating composition was compounded using an acrylic latex emulsion (Heveatex "4129FR"). The viscosity of the emulsion was adjusted to a Brookfield viscosity (#4 spindle, 40 speed) of about 60,000 cps with about 5wt % of an acryloid thickener (Acrysol™GS, Monsanto Colo., St. Louis, Mo.). The modified emulsion had a total solids content of about 60% by weight, a density of about 10 pounds per gallon (1.8 g/lcm^3), and a pH of between about 7.5 and 9.5.

The emulsion was applied using a knife over roll coater (JETZONE Model 7319, Wolverine Corp., Merrimac, Mass.) to one side of a silver-plated nylon fabric (Swift "31EN RIPSTOP") having a thickness of about 4 mils (0.1 mm). With the fluid level in the coating trough of the coater maintained at about 4 inch (10 cm), the emulsion was delivered to the surface of the cloth at a hydrodynamic pressure of about 0.05 psi (0.35 kPa). The coating knife was shimmed to a 10 mil (0.25 mm) gap above the fabric to yield a wet coating draw down thickness of about 10 mils. Following an oven curing at 100–125° C. for 5 minutes, a dried coating or film thickness of about 2.5 mils (0.635 mm) was obtained with a weight pickup of about 130–145 g/yd^2 and a total material thickness of between about 6–7 mils (0.15–0.18 mm). An inspection of the coated fabric cloth revealed a coating penetration depth of about 1–2 mils (0.02–0.05 mm) providing acceptable mechanical retention and/or adhesion of the coating onto the fabric surface. The opposite side of the fabric, however, was observed to be substantially coating free, and to retain a surface resistivity of about 0.1 Ω/sq for unaffected EMI shielding effectiveness.

Fabric samples similarly coated in the manner described were subjected to an in-house vertical flame test. No burning was observed at dried film thickness of 2, 3, or 4 mils (0.05, 0.08, 0.10 mm). Accordingly, a reasonable operating window of film thickness was suggested for production runs.

Samples also were provided, as jacketed over a polyurethane foam core in an EMI shielding gasket construction, for flame testing by Underwriters Laboratories, Inc., Melville, N.Y. A flame class rating of V-0 under UL94 was assigned at a minimum thickness of 1.0 mm. The gasket construction therefore was found to be compliant with the applicable UL requirements, and was approved to bear the "UL" certification mark.

The foregoing results confirm that the EMI shielding material of the present invention affords UL94 V-0 protection when used as a jacketing in a fabric-over-foam gasket construction. Unexpectedly, it was found that a relatively porous or permeable fabric may be wet coated on one side with a relatively thin, i.e., 2–4 mil (0.05–0.10 mm), coating layer of a flame retardant composition without compromising the electrical surface conductivity of the other side. Such a thin coating layer, while being sufficient to provide UL94 V-0 protection in a conventional fabric-over-foam gasket construction, nonetheless maintains the drapability the fabric and thereby facilitates the fabrication of UL94 V-0 compliant gaskets having complex profiles or narrow cross-sections down to about 1 mm.

As it is anticipated that certain changes may be made in the present invention without departing from the precepts herein involved, it is intended that all matter contained in the foregoing description shall be interpreted as illustrative and not in a limiting sense. All references cited herein are expressly incorporated by reference.

What is claimed is:

1. A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being

electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer comprising at least about 50% by dry weight of one or more flame retardant additives and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

2. The gasket of claim **1** wherein said flame retardant layer has a thickness of between about 2–4 mils (0.05–0.10 mm).

3. The gasket of claim **1** wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion.

4. The gasket of claim **1** wherein said fabric member is a metal-plated cloth.

5. The gasket of claim **4** wherein said cloth comprises fibers selected from the group consisting of cotton, wool, silk, cellulose, polyester, polyamide, nylon, and combinations thereof, and said metal is selected from the group consisting of copper, nickel, silver, nickel-plated-silver, aluminum, tin, and combinations thereof.

6. The gasket of claim **1** wherein said foamed elastomeric material is selected from the group consisting of polyethylenes, polypropylenes, polypropylene-EPDM blends, butadienes, styrene-butadienes, nitriles, chlorosulfonates, neoprenes, urethanes, silicones, and polyolefin resin/monoolefin copolymer blends, and combinations thereof.

7. The gasket of claim **1** wherein said fabric member has a thickness of between about 2–4 mils (0.05–0.10 mm).

8. The gasket of claim **1** wherein said flame retardant layer is effective to afford the gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

9. The gasket of claim **1** wherein said one or more flame retardant additives are selected from the group consisting of aluminum hydrate, antimony trioxide, phosphate esters, and halogenated compounds.

10. The gasket of claim **1** wherein said flame retardant layer comprises between about 50–83% by dry weight of one or said one or more flame retardant additives.

* * * * *

EXHIBIT D

David Loretto

From: Steve Nash [SNash@cblh.com]
Sent: Friday, May 09, 2008 2:28 PM
To: John Garretson; John Pegram; sdaniels@whdapatentlaw.com
Cc: David Loretto; William Marsden; khattori@whdapatentlaw.com; mcaridi@whdapatentlaw.com; Heaney, Julie; Frank DiGiovanni
Subject: RE: PH v. ZTJ/Seiren - new schedule
Attachments: 2008.05.02 SMD Letter re list of terms to be construed.pdf

John & Scott,

We have not determined a date for exchanging proposed claim constructions. This may be in part due to the question raised in Scott's letter of May 2 (attached) concerning the '393 and '523 patents. To answer that question, Parker is not asserting the '393 and '523 patents, and we intend to withdrawal those patents from the cases. Therefore, we do not believe that any claim construction is needed with respect to them.

In any event, I would like to confirm that we are not exchanging proposed claim constructions this week. I suggest that we exchange claim constructions next Thursday, May 15. That should give us plenty of time to prepare the joint claim construction chart due June 2. Please let me know if Zippertubing and Seiren agree.

Regards,
Steve

From: John Garretson [mailto:Garretson@fr.com]
Sent: Tuesday, April 29, 2008 5:14 PM
To: Steve Nash; John Pegram; sdaniels@whdapatentlaw.com
Cc: Lennon, Jim; David Loretto; William Marsden; khattori@whdapatentlaw.com; mcaridi@whdapatentlaw.com; Heaney, Julie; Frank DiGiovanni
Subject: RE: PH v. ZTJ/Seiren - new schedule

Steve,

Confirming our call earlier this afternoon, the parties have agreed to exchange initial proposed claim constructions next week (date to be determined). On May 1, the parties will only exchange lists of claim terms. I'll call you tomorrow regarding next steps.

Thanks,

John

From: Steve Nash [mailto:SNash@cblh.com]
Sent: Tuesday, April 22, 2008 6:07 PM
To: John Pegram; sdaniels@whdapatentlaw.com
Cc: Lennon, Jim; John Garretson; David Loretto; William Marsden; khattori@whdapatentlaw.com; mcaridi@whdapatentlaw.com; Heaney, Julie; Frank DiGiovanni
Subject: PH v. ZTJ/Seiren - new schedule

John & Scott,

We have filed the new proposed scheduling order in each of the ZTJ and Seiren cases. Copies are attached.

Regards,
Steve

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Admitted in Pennsylvania

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EXHIBIT E

Guidelines for Patent Claim Construction

The Basics of a "*Markman*" Hearing

Federal Circuit Bar Association
Patent Litigation Committee
Markman Project

Guidelines for Patent Claim Construction

I. Introduction

Claim construction is the process by which a Court determines what the claims of a patent mean. Although patents contain substantial information about the invention (e.g., background, drawings, examples, and a detailed written description), the claims determine the scope of the patentee's exclusive rights.

A. Patent Claim Construction

Years ago, claim construction was rarely an explicit issue in patent cases. Unless the Court granted summary judgment, the issue was left for the jury to sift through in deliberating its verdict. Typically, this process produced no record of the claim construction.

Following the Supreme Court's decision in *Markman v. Westview Instruments, Inc.*, claim construction has become perhaps the single most important aspect of any patent case. In *Markman*, the Supreme Court concluded that claim construction is for the trial court to decide, and not an issue for the jury. Rather, claim construction is a threshold issue.

The ability of trial courts to resolve claim construction before trial has re-defined patent litigation. Claim construction shapes – and often resolves -- key liability issues, including infringement and invalidity. Accordingly, its timing may dramatically affect the scope and cost of discovery and of the case as a whole.

Claim construction may require the investment of additional time and resources by the district court. A variety of factors influence whether or not it is more efficient and effective to construe the claims early in the case rather than later. Moreover, the appellate reversal and remand rates for claim construction decisions have remained persistently high. Unfortunately, high reversal rates and the availability of *de novo* appellate review tend to encourage appeals.

The purpose of these Guidelines is to provide practical assistance to district courts, their staffs, members of the Bar, and litigants. This is not an academic treatise. This is intended to be a practical guide, based on the experience of the bench and bar in construing claims. Numerous sources of scholarly treatment of claim construction issues are readily available. A list of some additional resources is provided in the Appendix. Rather, these Guidelines are intended to assist district courts in construing claims in a cost-effective manner and in a way that will increase the likelihood that their claim construction decisions will be affirmed on appeal.

B. General Principles

In July 2005, the Federal Circuit issued an *en banc* decision in *Phillips v. AWH Corp.* *Phillips* reaffirmed and amplified many of the Court's prior decisions detailing

various aspects of claim construction. It also clarified certain of the Court's prior precedents regarding the proper role of dictionaries, modified others regarding the importance of the specification relative to general purpose dictionary definitions, and emphasized the critical role of the specification in determining what the claims mean.

Four principal sources of evidence are available to the trial court in construing claims: the language of the claims; the specification; the prosecution history; and extrinsic evidence. Philips clarified the role and relative importance of each type of evidence. In general, the ordinary meaning of the terms used in the claims to one of ordinary skill in the art is determined in the context of the specification. The prosecution history, if in evidence, is evaluated to determine whether or not the inventor disclaimed or disavowed any scope that may otherwise be considered to be within the claims. Yet, because the prosecution history reflects an ongoing negotiation between the applicant and the Patent Office, rather than the outcome of that negotiation, it often lacks the clarity of the specification and thus is less useful than the specification for claim construction purposes. Finally, extrinsic may be useful but is generally less reliable than the patent and its prosecution history in construing the claims.

Phillips reaffirms that claim construction is a question of law. The Court in *Phillips* did not address the further issue whether or not deference should be given to the district court's determination of subsidiary facts in reaching a claim construction ruling.

C. Treatment of Factual Issues

Under current precedent, the terms used in the claims must be construed as they would be understood by persons of ordinary skill in the art. With respect to claim construction, these issues are resolved, in the first instance, by the district court. Unlike findings of fact on substantive issues in a case, any findings of fact necessary to construe the claims are not entitled to deference on appellate review under current law. Rather, they are subject to *de novo* review on appeal. Although on a motion for summary judgment, contested facts would be construed in favor of the non-moving party, these presumptions do not apply to claim construction.

II. Background

A. The Public Notice Function of Patents

A patent provides notice to the public of the scope of the patentee's rights. The public record of the patent makes up the "intrinsic" evidence: the claims; the specification; and the prosecution history. The prosecution history includes the administrative record of the interaction between the patent applicant and Patent and Trademark Office from when the patent application was submitted until the patent was issued. This intrinsic evidence is the primary evidence of the scope of the patent rights.

The intrinsic evidence must be viewed from the vantage point of one skilled in the art. Reference materials that were publicly available at the time, such as dictionaries or technical references may provide background or context for determining how one of ordinary skill in the art would have considered the terms used in the claims. Reference texts, such as dictionaries, treatises, and expert and inventor testimony are generally known as "extrinsic evidence."

The intrinsic evidence is the primary evidence in the claim construction analysis. Extrinsic evidence is less useful. There are a number of reasons why the intrinsic evidence is accorded greater weight than extrinsic evidence. Among them, any change in meaning from the contemporaneous intrinsic evidence based on extrinsic evidence may undermine the public notice function of patents. The Federal Circuit has concluded, while extrinsic evidence may be considered, it is unlikely to result in reliable interpretation unless considered in the context of the intrinsic evidence. Thus, the district court may consider the extrinsic evidence in its sound discretion, mindful of its flaws and limitations.

III. The Timing of Claim Construction

The district court has substantial flexibility in the timing of claim construction. Claims may be construed at any time until the case is submitted to the jury or decided by the Court. Although delaying claim construction may provide the court with a fuller evidentiary record or better appreciation for the issues, it may not be the most efficient or effective way to resolve the parties' dispute. Delaying claim construction leaves the parties without guidance that might otherwise help narrow the issues or resolve the case without requiring the time and expense of a full trial on the merits. The parties may continue to discover and try their cases through the motions period based on alternative claim constructions. The district court must, therefore, weigh the benefits of early claim construction against the adequacy of the factual record and the development of the issues available to the court at that stage of the case.

The claims may be construed at any of several stages, for example: early in the case before substantial discovery has occurred; while discovery is ongoing; after the completion of discovery; or at any point before the case is submitted to a jury or the court renders its decision in a bench trial. It is up to the district court to determine what is best in any particular case, and there is often no "correct" answer.

As with any interlocutory decision by the court, the district court is free to revisit and alter its construction of the claims. The district court may be inclined to do so as its understanding of the technology evolves as it receives more evidence during the course of a case. Specifically, even after the district court issues a written order providing its claim construction, that decision is not final. Thus, that construction may be modified by a subsequent order of the court. The parties will normally rely on the court's claim construction in how they litigate the case. Consequently, the court should strive to

minimize the prejudice that may be caused by any change in its claim construction during the course of the case.

A. Early Claim Construction

Claims may be construed before substantial discovery has occurred. Early claim construction may help streamline the case in a number of ways: (1) it may be dispositive; (2) it may narrow the issues; or (3) it may provide guidance to the parties as to what issues are significant and what evidence is needed for discovery and/or at trial. This can, and often does, encourage settlement.

The Court's ability and willingness to construe the claims early in the case, prior to the close of discovery, may depend on a number of factors. One important consideration is the extent to which claim construction may be case-dispositive. Another important consideration is the clarity of the terms used in the claims and the availability of adequate evidence from intrinsic sources. A third important consideration is the extent to which the parties have developed the record sufficiently to define the issues in the case. If the issues in the case are not well-defined, resources may be wasted resolving claim construction disputes that are ultimately irrelevant. At the same time, important claim construction disputes may arise only later in the case, requiring a second round of claim construction proceedings.

The intrinsic evidence, based on the claims, specification, and prosecution history, should be readily available. While extrinsic evidence may be less available early in the case, the court can mitigate this problem by providing the parties with an opportunity to conduct claim construction-related discovery. Discipline may be enforced by notifying the parties that evidence that could have been presented at the early claim construction proceeding will not be considered on any motion for reconsideration.

A chief benefit of performing claim construction before discovery is complete is that it can conserve the parties' and the court's resources by resolving the case rapidly, provided the court has sufficient evidence on which to base its ruling.

B. Claim Construction Before Expert Discovery

Resolving claim construction after fact discovery is substantially complete but before expert discovery and summary judgment is another common approach. This timing provides the parties with a greater opportunity to define the issues in the case and to collect evidence relevant to claim construction. While this approach does not offer the possibility of as prompt a resolution of the case as claim construction before the end of fact discovery, it nonetheless provides the potential to resolve the case before the added expense of expert discovery. In addition, it is early enough to focus the parties in their expert discovery and summary judgment efforts. This not only can result in the savings of significant resources but, by focusing the issues in the case, it may improve the quality of the evidentiary record.

C. Performing Claim Construction With Summary Judgment

Some district courts reserve claim construction until the summary judgment stage of the proceedings. This may improve the definition of the issues in the case, so the court can better understand the implications of its claim construction rulings. Because there has not yet been a claim construction ruling, however, the parties' experts may need to anticipate a broader range of potential alternative claim constructions. This may require that the experts perform an infringement and invalidity analysis under alternative constructions which, in turn, may complicate the expert discovery process. By the same token, it may offer the court additional evidence and insight to help inform its decision.

D. Reserving Claim Construction Until Trial

Some courts wait until trial to construe the claims. One reason to do this is that a claim construction hearing typically provides less time for development of an evidentiary record and definition of the issues than does a trial. If development of an appropriate record would require excessive time or resources before trial, or the claim construction is not critical to the case, it may be more efficient simply to try the case. The evidence may be taken during trial and the claims may be construed at any point before the jury is charged. Provided that claim construction will not be dispositive in a particular case and delaying it will not complicate the proof, this may be a viable option. Experience indicates, however, that cases in which this is true are relatively rare.

In some cases, the record may still be unclear or incomplete, even following fact and expert discovery. For example, the terms used in the claims may have special or non-standard meanings in the art. The parties may disagree strongly over how persons of ordinary skill in the art would have understood the terms. The parties may have submitted substantial, and inconsistent, evidence supporting these disparate views. These issues may become acute in complex or obscure technical fields, or in technical fields with short product development cycles that are evolving rapidly. The knowledge of persons of "ordinary skill in the art" may not be recorded in technical dictionaries or standard references. It may be identified only through the testimony of persons who were active in the field of the invention claimed in the patent at the time. When the relevant time frame is remote, such as when the patent was filed many years earlier, these issues may be very challenging.

Reserving the issue of claim construction in this manner, however, typically complicates trial. It forces the parties to try alternative claim constructions. This, in turn, may compel the parties to introduce evidence supporting multiple theories of the case, so that they have introduced sufficient proof, regardless which claim construction the court ultimately adopts. All of this may increase the length and expense of trial. More important, the admission of this extraneous and irrelevant evidence may confuse the jury.

E. Factors Affecting the Timing of Claim Construction

1. Ordinary and Customary Meaning

The claims define the invention. The starting point for claim construction,

therefore, is the ordinary and customary meaning of the terms used in the claims. The ordinary and customary meaning is the meaning that the term would have to a person of ordinary skill in the art. This ordinary and customary meaning establishes the baseline from which to begin claim interpretation.

The terms are not considered in a vacuum. Persons of ordinary skill in the art are deemed to read the claims in the context of the entire patent, including the specification. In some cases, the ordinary meaning will be readily apparent, in others it will not be so clear. To the extent that the meaning can be readily determined, that factor may favor earlier construction. By the same token, the need to consider other sources of evidence may indicate that construction should be delayed, at least long enough to make a full record.

2. The Claims Themselves

The claims themselves may provide substantial guidance. the context in which a term is used in a claim may be highly instructive. For example, the use of an adjective with a noun may imply that the noun lacks the property described by the adjective when it is used without that adjective. Other claims may also provide guidance, as a term is generally used consistently throughout a patent. Similarly, the presence of a term or limitation in a dependent claim may imply that it is not inherent in the independent claim.

3. The Specification and Prosecution History

The claims do not stand alone. They are an integral part of a larger specification. The specification is the primary basis for construing the claims. The specification may indicate that the invention should be construed broadly. Alternatively, in some cases, it may reveal a special definition for a term or an intentional disclaimer or disavowal of claim scope by the inventor.

The patentee is permitted to define in the patent the terms that are used in the claims. The quality of the definitions, however, may vary widely. The meaning of claim terms may vary with the quality of the drafting of the application and the clarity of the meanings of the terms in the art. Where the Applicant has provided clear definitions, or terms are clearly and readily understood in the art, early construction may be appropriate. Where the meaning is more obscure, delaying construction until a later stage of the proceedings may be more appropriate.

Similarly, the inventor may have limited the invention either in the specification of during prosecution. The inventor may have dictated the scope of the claims in the specification. If so, that disclaimer or disavowal may be dispositive. Although the prosecution history may not be as clear or as useful in this regard as the specification, the inventor also may have disclaimed or disavowed certain scope of the claims during prosecution. A clear statement of claim scope, or an explicit disavowal or express disclaimer may favor early resolution. A record that is less clear will likely be less useful in this regard.

4. Level of Technical Complexity

Technical complexity may encourage delaying claim construction to permit fuller development of the record. In complex cases, tutorials or even expert testimony, may assist the court. The court may also appoint a technical expert or special master.

Claims are construed as they would be understood by persons of ordinary skill in the art. The use of claim terms as technical terms of art, rather than the common ordinary meaning of the terms, may favor additional factual development.

5. Level of Legal or Logistical Complexity

The presence of multiple patents and/or multiple claims may also favor delaying claim construction. Multiple patents and/or claims may generate additional burdens on the court. The court may benefit from procedures to eliminate or simplify claims. In addition, the court may require the parties to categorize and prioritize patents and/or claims for purposes of claim construction. The claims may be categorized and/or prioritized based on common terms appearing in certain of the claims. Discovery directed to these issues may facilitate this process. The parties may also be asked to identify representative claims to help streamline the analysis.

6. Lack of Clarity

The patentee is entitled to write the claims in any fashion, within the limits of the patent laws. This may result in substantial variability. Unfortunately, the terms used in the claims may not be clear. For example, terms of art, unique to a particular field of technology, may be used. Because the meaning may not be readily apparent and the inventor may have used the terms idiosyncratically, the court should look to the words of the claims themselves, the remainder of the specification, the prosecution history, and, if appropriate, the extrinsic evidence.

Care is required to ensure that the extrinsic evidence is used appropriately. Extrinsic evidence may illuminate how persons of ordinary skill in the art viewed a term or concept. Nonetheless, it is less significant and less reliable than the intrinsic evidence in determining the meaning of the terms used in the claims. Extrinsic evidence cannot cure a fundamental defect of lack of definiteness or ambiguity, nor can it modify the claims in a manner inconsistent with the intrinsic evidence. The court should discount any extrinsic evidence that is at odds with the intrinsic evidence. Lack of clarity may indicate that claim construction should be delayed. This may also permit fuller development of the various legal issues (e.g., adequacy of written description, definiteness, etc.) it may raise.

7. The Parties' Positions on the Timing of Claim Construction

As with any complex litigation, the district court will likely consider the parties' views on the timing of claim construction. The parties, however, may be driven by tactical considerations that the Court may find valid, or may choose to ignore.

A patentee may favor late claim construction to retain some degree of uncertainty in the hopes of keeping pressure on the defendant(s) to settle. Alternatively, a patentee may favor early claim construction in order to reduce costs and streamline or simplify the issues in the case. Similarly, a patentee with a weak case on the merits may favor early claim construction in the hope that the record will not be developed adequately to reveal those weaknesses. An alleged infringer may favor early claim construction, regardless of the strength or weakness of their case, simply to interpose an additional impediment to getting the case to trial. Both parties may agree to early or late claim construction as a case management vehicle, in order to focus the issues, or to facilitate orderly disposition of the case.

The parties' positions on timing of claim construction, therefore, may be confounded by many factors that may be pertinent or irrelevant to the Court's interests. Nonetheless, the Court may wish to encourage the parties to agree to an efficient procedure.

8. Anticipated Effect of the *Markman* Ruling

Although the effect of a particular *Markman* ruling is not technically relevant to the construction of the claims, the district court typically will want to know the potential consequences of ruling one way or the other. This may indicate the urgency of the issue or the efficiency of determining these issues earlier, or later, in the proceeding.

(a) Case Dispositive

If a claim construction ruling may dispose of the entire case, claim construction early in the case, or during or immediately following fact discovery, may help conserve the Court's and the parties' resources.

(b) Narrow the Issues

Even if the claim construction is not case-dispositive, it will often eliminate or narrow issues. Eliminating issues may favor early construction. These same factors may favor claim construction following fact discovery. If the claim construction issue will not be dispositive, discovery on other issues in the case should proceed while the Court is resolving the claim construction issues.

(c) Enhance the Potential for Settlement

Claim construction may also enhance the prospects for settlement. It may eliminate or narrow contested issues, clarifying the parties' options. Similarly, claim construction may affect or clarify the parties' damages theories. Where the claim

construction dramatically affects damages—whether by substantially enhancing or diminishing the damages—claim construction early in the case or following discovery may help foster settlement discussions and avoid unnecessary expense.

9. The Need for, and Appropriateness of, Extrinsic Evidence

Many district courts, as well as litigants, prefer to proceed to claim construction without extrinsic evidence. Yet, the Federal Circuit, prior to *Philips*, remanded several cases for the district court specifically to consider extrinsic evidence. The appropriate role of extrinsic evidence is now more clear. Although it may help "shed useful light on the relevant art," it is less significant and less reliable than the intrinsic evidence.

Where the court accepts extrinsic evidence, it is important to keep in mind its limitations relative to the intrinsic evidence. There are a number of reasons why the extrinsic evidence is accorded less weight, and considered less reliable than the intrinsic evidence. First, extrinsic evidence is by definition not part of the patent and was not created at the time of prosecution of the patent to explain the patent's scope and meaning. Second, extrinsic publications may not have been written for the same audience as the patent–persons of ordinary skill in the art of the patent--and may not reflect the understanding of skilled artisans. Third, testimony generated for purposes of litigation may suffer from bias that does not infect the intrinsic evidence. Fourth, the "virtually unbounded universe" of extrinsic evidence that may be of some marginal relevance places a heavy burden on the court to sift the wheat from the chaff. Finally, undue reliance on extrinsic evidence poses the risk of changing the meaning of the claims from the meaning indicated by the intrinsic evidence, undermining the public notice function of the patent.

Although it is permissible for the court to use extrinsic evidence, its inherent flaws and limitations make it less useful than the intrinsic evidence. The court may need to weight the availability of or desire to adduce additional extrinsic evidence against its relatively low level reliability in deciding when to construe the claims.

10. Related Litigation

The existence of prior or contemporaneous litigation may also affect the timing of claim construction. Prior litigation involving the same patents and/or claims may have *stare decisis* effect, if the prior decision was affirmed on appeal and/or the time for appeal has expired. A final judgment on the construction of claims in a prior case may not be given collateral estoppel or *res judicata* effect, if the defendant was not a party to the prior case. Nonetheless, as a prior decision on a question of law, the doctrine of *stare decisis* encourages adherence to that claim construction in subsequent cases where the facts are substantially the same, regardless whether or not the parties and alleged infringement are the same.

These factors may influence whether or not the district court will consider the claim construction issues at all in a subsequent case. Although a subsequent defendant may argue that they are entitled to a different claim construction than was

held in a prior proceeding, *stare decisis* may compel that the construction rendered in a prior decision be followed, provided it is a final judgment or no appeal was timely taken from it.

The parties may also be in contemporaneous litigation involving the same patents, claims, or parties. In that situation, there may be no collateral estoppel or *res judicata* effect of the prior judgment. Nonetheless, the prior decision may be persuasive. One party or the other may be seeking a tactical advantage by trying to get a claim construction ruling in one court, for use in another.

For example, it has become relatively common for parties to pursue parallel district court litigation while involved in an International Trade Commission (ITC) Investigation on the same patent, in order to develop additional options for claim construction. For these reasons, the parties should be required to identify any related litigation and the potential effect each case may have on the other.

A unique situation arises when related litigation is pending in the ITC. The ITC has jurisdiction over patent claims in the import trade. Although its determinations are not binding on the district courts, even if affirmed on appeal to the Federal Circuit, they may be persuasive. Some of the ITC's Administrative Law Judges have substantial experience in interpreting patent claims. Moreover, the ITC's procedures permit development of a full evidentiary record, which may be useful in construing the claims.

IV. Format of the *Markman* Hearing

Markman hearings may range from submissions on the papers, to multiple day evidentiary hearings, to mini-trials, to a consolidated hearing with trial on the merits.

A. Submission On the Papers

Although some cases may be decided on the papers, this is not common. Proceeding on the papers may be simple and may conserve the court's resources. Yet, oral argument provides the parties an opportunity to assist the court to understand the issues. In addition, an evidentiary hearing may provide the parties or their experts an opportunity to explain the technology and nomenclature involved in the case.

Deciding claim construction on the papers alone limits the evidentiary record. The patent and prosecution history will typically be submitted with the briefs. Deciding the issues without oral argument, however, deprives the district court of the benefit of argument of counsel and the opportunity to ask questions to test perceived weaknesses in the parties' arguments. Nonetheless, this approach may be appropriate in cases involving simple issues and simple technology and/or where there is no substantial issue as to the appropriate construction.

B. Deciding the Issue on Briefing and Argument, Without an Evidentiary Hearing

Deciding claim construction issues on briefing and oral argument but without an evidentiary hearing is another approach. Again, the patent and prosecution history will typically be submitted as part of the record. The court may decline, however, to accept extrinsic evidence.

This approach may be appropriate where the intrinsic evidence is clear. It provides the Court the added benefit of argument of counsel, or at least the opportunity to ask questions to develop the issues or test perceived weaknesses in the parties' arguments. Particularly where the Court perceives meanings that were not argued by either party, this approach is preferable to deciding the issues on the papers alone because it gives the Court an opportunity to test those perceived meanings.

C. Deciding the Issue Based Upon an Evidentiary Hearing

The court may allow the parties an opportunity to present live testimony. Each party may offer the testimony of an expert and, potentially, a fact witness. Even if each party presents two witnesses (one fact and one expert), the hearing typically can be concluded in a day, unless there are a unusually large number of claim terms at issue. the court must keep in mind, however, the limitations on the role and usefulness of extrinsic evidence. This may limit to usefulness of, or need for, extensive testimony or evidentiary submissions.

V. Evidence Pertinent to Claim Construction

A. The Language of the Claims

In construing a claim, the court first consults the language of the claims themselves. The words in the claims are generally given their ordinary and customary meaning. That is the meaning they would have to a person of ordinary skill in that art at the time of the invention. The person of ordinary skill is considered to read the term not only in the context of the claim in which it appears but in the context of the entire patent, including the specification.

B. Reference Materials

Where the ordinary meaning of the claim language is clear, general purpose dictionaries may be helpful. Yet, patentees often use terms idiosyncratically. In these situations, the court may need to look to other sources, including the words of the claims themselves, the specification, the prosecution history, and extrinsic evidence. In this regard, contemporaneous dictionaries, treatises, and other reference materials may be considered. Reference materials may be used in several ways. They may provide insight into the common, ordinary meanings of terms. Even if the terms are accorded a different meaning, they may shed light on what one of ordinary skill would

have considered the terms to mean at the time. They may also provide context. Yet, they are always less significant than the intrinsic evidence, namely, the claims, the specification, and the prosecution history.

References are subject to certain limitations. First, a reference is of more valuable if it is contemporaneous. References published well after the application was filed may be of little use and, indeed, may be affirmatively misleading. Although nomenclature may be stable in some fields, in other fields it may change rapidly, be inconsistent, incomplete, or entirely lacking at a certain period during the development of the technology. Moreover, a particularly successful invention may itself have an effect on subsequent editions of treatises or dictionaries. They may add to or alter the meaning of terms. Thus, the time frame is often critical.

Second, dictionaries and treatises are general references. Normally, words have multiple, generally accepted meanings. General references typically compile multiple meanings used not only in the particular field of art of the invention but in several different fields, inevitably extending beyond the meaning to one of ordinary skill in the art of the invention. These references may or may not reveal how one of ordinary skill in the particular art would understand the terms. As general references, they do not necessarily share the same context as the invention.

Moreover, different dictionaries may contain different meanings for the same words. Claim construction should not rise or fall based on the selection of the particular reference or the selections of the editors of those references.

These limitations must be kept in mind when considering dictionaries and other reference materials.

C. The Intrinsic Evidence

1. The Claims

The claims define the invention. Words used in the claims are generally given the ordinary and customary meanings they would have to a person of ordinary skill in the art at the time of the effective filing date of the application.

The context of a claim can be particularly helpful. The use of an adjective with a particular noun in a claim term is typically interpreted differently--and more narrowly--than the use of the same noun without the accompanying adjective.

Similarly other claims may inform the meaning of a term in a particular claim. Terms are normally used consistently throughout a patent. Thus, the meaning of a term may help inform the meaning of the same term in other claims.

Differences between claims may also help define the terms. For example, a dependent claim that includes a particular term may indicate that its independent claim lacks the added limitation.

2. The Specification

Persons of ordinary skill are considered to read the words used in a claim in the context not only of the particular claim itself but in the context of the entire patent. A patent is a fully integrated legal instrument. The specification is always highly relevant and is the single best guide to the meaning of claims terms. Thus, the specification is the primary basis for construing the claims.

The patentee has the option of defining the terms that are used in the patent. The specification may reveal a special definition. Specifically, the patentee may define the terms differently than they would be understood by persons of ordinary skill in the field of the invention. Where the patentee has clearly defined the terms, those definitions govern construction of the claims.

In addition to the plain language of the claims themselves, the patent contains a description of the field and background of the invention, a written description, and drawings illustrating the invention. The specification illustrates and provides examples of the invention. These examples do not limit the invention, unless the patentee has expressed a clear intent to do so. Reading a limitation from the written description into the claims remains one of the cardinal sins of patent law.

Nonetheless, the patentee may have limited the invention to certain embodiments or may have distinguished the invention from prior inventions. When the specification reveals an intentional disclaimer, or disavowal, of claim scope by the inventor, the invention may be limited to the embodiments or examples the Applicant has described as the invention.

3. The Prosecution History

The prosecution history should be considered whenever it is in evidence. If the prosecution history has not been introduced into evidence, the Court should request it. The prosecution history constitutes an official Government record of the patent application and the Court is encouraged to refer to it. The prosecution history records the give and take between the inventor and the Patent and Trademark Office leading to the issuance of the patent. To the extent that the inventor limited the invention or distinguished it from prior art in order to secure the patent, these limitations are critical and must be considered.

The prosecution history, however, is typically written in a highly stylized and cryptic language. Care must be taken to understand and consider these statements in context, particularly when they are being read as limiting or distinguishing the invention from the prior art.

The prosecution, like the specification, was created by the inventor in attempting to explain and obtain the patent. Yet, because the prosecution history represents an ongoing negotiation between the patentee and the Patent Office, rather than the result of that negotiation, it often lacks the clarity of the specification and thus is less useful

than the specification in construing the claims.

Nonetheless, the prosecution history may reveal how the inventor understood the invention and whether or not the inventor limited the invention in attempting to obtain their patent. Thus, the court should preclude any interpretation that was disclaimed during prosecution.

3. Cited Prior Art

The prior art references cited in the patent and prosecution history are part of the intrinsic evidence. The Examiner is presumed to have reviewed all of the cited references. The cited references may provide substantial and valuable evidence of how certain terms were understood at the time of the invention. The cited references may define terms that are not defined in dictionaries, treatises, or references, or that the patentee failed to define.

D. Extrinsic Evidence

Various types of extrinsic evidence have been offered in claim construction proceedings. For example, witness testimony, and statements or documents authored by the inventor, patentee, or alleged infringer, are frequently relied upon by the parties to attempt to construe claims.

Extrinsic evidence, however, is always less significant than the intrinsic evidence in construing the claims. It can never alter or change the meaning of a claim term in a manner that is inconsistent with the intrinsic evidence. The weight to be given the different forms of extrinsic evidence will depend on the circumstances.

1. Uncited Prior Art

Uncited prior art is not normally relied upon in construing the claims. It can be useful if it shows a consistent usage of disputed claim terms. However, because there are often numerous uncited prior art references, uncited prior art selected and submitted by a party may not be representative of the usage of the terms in the field as a whole.

Nonetheless, the parties may argue that uncited prior art may be pertinent. Patents and publications, as may any other reference work, may reflect how persons who were skilled in the art at that time considered and used a term that appears in the patent claims. As with the cited references, the uncited art should be contemporaneous with the invention.

2. Testimony

Testimony is typically offered from several sources: the inventor; the patentee; the alleged infringer; technical experts; legal experts; or experts on Patent Office procedure. While some of these sources may be helpful to the court, others are unreliable and may be affirmatively unhelpful to the court.

(a) Inventor, Patentee, and Alleged Infringer Testimony

The inventor's testimony is generally disfavored when it is self-serving or conflicts with the intrinsic evidence. Claim construction is governed by the language of the claims themselves. It is not defined by the inventor's subjective intent. Rather, that intent must be expressed objectively in the intrinsic evidence.

The admissions of an inventor against interest may be relevant, where they help shed light on how an objective person skilled in the art would understand the intrinsic evidence. As in other areas of law, statements against interest can have substantial probative value. The patent owner's and/or alleged infringer's testimony is often offered as an alleged admission against interest on claim construction issues. Nonetheless, it must be kept in mind that the extrinsic evidence is less reliable than the patent and its prosecution history.

(b) Technical Experts

Technical experts may provide testimony or identify other evidence on how terms were understood by persons of ordinary skill in the art at the time the invention was made. Expert opinion testimony may be helpful to the Court in explaining the context of the claims. Further, expert testimony may be helpful in synthesizing complex evidence about the technical matters that may be relevant to claim construction. As background, it may explain whether or not a particular term had a particular meaning in the pertinent field of art. ..

As in other areas of law, courts must distinguish between unreliable experts who provide biased testimony and those who provide testimony that is helpful to the court and supported by the evidence. In addition, admissions by experts may help narrow the issues in dispute and identify common ground.

Conclusory, unsupported assertions by experts, however, are not useful to the court. Specifically, the court should discount any expert testimony that is at odds with the claim construction mandated by the claims, the specification, and the prosecution history.

(c) Substantive Patent Law Experts

Experts offered to opine on patent law generally are not appropriate. They should not be permitted unless they add something helpful to the court, beyond what an advocate can add in oral argument or what a court and its clerks can discern from the record and their legal or factual research.

Some observers have suggested appointing a special master or technical consultant to advise the court on the proper construction of the claims. Although these tools may be efficient and useful with respect to factual issues, they are not appropriate with respect to legal issues. It is the court's role to construe the claims as a matter of law. Opinion testimony on legal issues invades the court's role to determine the law.

(d) Experts on Patent Procedure

Patent experts may also be offered on Patent Office procedure. Specifically, they may be offered to explain the significance of certain events that occurred or statements that were made during prosecution. This may be particularly tempting to a party if the patent was involved in reissue, or reexamination, or interference proceedings. To the extent that such testimony provides context or simply explains the facts surrounding a particular procedure, it may be helpful to the court. Care must be taken, however, to ensure that the expert's testimony is limited to appropriate subject matter, namely procedural matters, and does not invade the court's authority to determine the law.

VI. Contentions

Parties often resist giving their contentions on claim construction. For example, the patentee may resist disclosing their claim construction until they are aware of what prior art the accused infringer will rely upon. The accused infringer, in turn, may resist disclosing their contentions on infringement and validity until they have received the patentee's claim construction. In many cases, the parties will promulgate contention interrogatories, yet, agree that neither side need respond to them. Alternatively, the parties may agree that a corporate representative will provide that information, only at a later stage in the proceeding.

While these practices may preserve the parties' options and flexibility, they delay framing and narrowing the issues. It typically helps the court to have the parties' contentions early in the case. This may help identify critical issues, frame discovery, simplify and streamline the case, and narrow the issues. Some courts have found it helpful to require the parties to provide their claim construction contentions early in discovery, shortly after the Rule 26(f) scheduling or case management conference.

Several district courts have instituted local rules or implemented procedures through Scheduling Orders to require disclosure of the parties' contentions early in the discovery process. A listing of some published district court local rules is provided in Appendix B. Although there is no universally required procedure, a typical procedure follows:

- Within a limited period of time (a few weeks) following the entry of the Rule 26(f) Scheduling Order, the patentee discloses which claims of the patent they are asserting in the action and provides to the alleged infringer a claim chart, identifying their construction of each term and their contentions of how the defendant infringes that claim.

- Within a limited period of time following service of the patentee's construction (typically a few weeks), the alleged infringer discloses to the patentee a claim

chart identifying their construction of the claims, along with their contentions whether or not each claim is invalid, not infringed, and/or unenforceable, and the basis for those contentions.

- Within a limited period of time following receipt of the defendant's contentions, and well in advance of the close of discovery, the patentee serves their rebuttal contentions regarding validity, infringement, and enforceability.

This exchange provides the parties and the Court information from which to determine the scope of discovery and the timing of a claim constriction.

Some courts that employ these types of procedures schedule a *Markman* hearing following the end of discovery.

VII. Issues Raised *Sua Sponte*

The Court may identify, or perceive, issues that neither of the parties has identified or briefed. Basic fairness suggests that the parties should have a full and fair opportunity to address such issues before the Court rules on them. Furthermore, as a general proposition, deciding issues, particularly potentially complicated issues such as claim construction, without input from the parties can increase the potential for error. This is particularly true in claim construction proceedings that involve complex, technical issues. While an invention may seem obvious, persons skilled in the art may view the issue very differently than a lay person.

Securing the parties' input on an issue may require the parties to rebrief or reargue an issue. These costs, however, are relatively minor, particularly in view of the substantial benefits of having the issue fully developed. In addition, the parties may perceive that they have been denied a full and fair opportunity to address the issue where the court adopts a theory on which the parties had no opportunity to submit evidence, briefing, or argument.

VII. Appeal

A claim construction ruling, by itself, is generally not appealable. An issue can be appealed only in certain ways: (1) final judgment, resolving all claims; (2) certification of a judgment resolving fewer than all of the claims pursuant to Fed. R. Civ. P. 54(b); and (3) certification of an issue for interlocutory appeal.

In order to certify an issue for appeal under Fed. R. Civ. P. 54(b), the Court must make certain specific findings that support taking an appeal on less than all of the issues in a case. The Federal Circuit generally disfavors partial appeals. It will

rigorously review those certification findings and may remand the case to the district court.

Although the issue of claim construction could be certified for interlocutory appeal, the Federal Circuit has been generally unwilling to hear interlocutory appeals of claim construction issues. It is unlikely that an interlocutory appeal from a claim construction ruling will be accepted by the Federal Circuit.

Appendix A

Useful References on Claim Construction

1. Kenneth R. Adamo, *Get On Your Marks, Get Set, Go: or "And Just How Are We Going To Effect Markman Construction In This Matter, Counsel?"*, 670 PLI/Pat 183, (2001).

2. Patent Litigation Committee, American Intellectual Property Law Association, *The Interpretation of Patent Claims*, 32 AIPLA Q.J. 1 (Winter 2004).

3. Gary M. Hoffman & Charles W. Saber, *Markman Determinations*, 2 Sedona Conf. J. 171 (Fall 2001).

4. Constance S. Huttner, et al., *Markman Practice, Procedures and Tactics*, 531 PLI/Pat 535 (1998).

5. George F. Pappas, *Patent Claim Construction After Markman*, SD20 ALI-ABA 181 (1998).

Appendix B

District Court Local Patent Rules

1. United States District Court for the Northern District of California, Patent Local Rules, available at http://www.cand.uscourts.gov/.

2. United States District Court for the District of Delaware, Chief Judge Robinson, Scheduling Orders, available at http://www.ded.uscourts.gov/SLRmain.htm.

3. United States District Court for the Eastern District of Texas, Patent Rules, available at http://www.txed.uscourts.gov/.

EXHIBIT F

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/142,803	05/09/2002	Michael H. Benyus		3303

ZI94 7590 04/09/2002

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EXAMINER	
CAMERON, ERMA C	
ART UNIT	PAPER NUMBER
1762	3

DATE MAILED: 04/09/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

PH-000451

MS #8-3

Office Action Summary	Application No.	Applicant(s)	
	10/142,803	BUNYAN ET AL	
	Examiner	Art Unit	
	Erma C. Cameron	1782	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is FINAL. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-7 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-7 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

U.S. Patent and Trademark Office
PTO-326 (Rev. 04-01) Office Action Summary Part of Paper No. 3

PH-000452

DETAILED ACTION

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a) Claim 3: layer of is ??

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a construction wherein the flame retardant coating does not penetrate to the full depth of the fabric member, so as to retain the electrical conductivity of the side not penetrated by flame retardant composition, does not reasonably provide enablement for any EMI shielding construction. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

See page 9, lines 12-28.

PH-000453

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1 130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b)

6. Claims 1-7 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8 of U.S. Patent No. 6387523. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims 1-7 do not claim the depth of the fabric that is penetrated, as does 6387523. However, the specification of the instant application very clearly specifies that the fabric member has delimited penetration by the flame retardant composition.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

PH-000454

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erma C. Cameron whose telephone number is 703-308-2330. The examiner can normally be reached on 8:30-6:00, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on 703-308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3599 for regular communications and 703-872-9475 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Erma Cameron

ERMA CAMERON
PRIMARY EXAMINER

Erma C. Cameron
Primary Examiner
Art Unit 1762

August 6, 2002

PH-000455

Notice of References Cited	Application/Control No. 10/142,803	Applicant(s)/Patent Under Reexamination BUNYAN ET AL	
	Examiner Erma C. Cameron	Art Unit 1762	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-2001/0028558 A1	10-2001	Repp et al	361/818
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	WO 00/23513	04-2000	WO	Bunyan	-
	O	WO 01/10182	02-2001	WO	Kaplo et al	-
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PH-000456

EXHIBIT G

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Bunyan, *et al.*	)	Examiner E. Cameron
Serial No. 10/142,803	)	Group Art Unit: 1762
Filed: May 9, 2002	)	November 13, 2002
For: Flame Retardant EMI Shielding Gasket	)	Cleveland, Ohio 44124-4141

COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

AMENDMENT AND RESPONSE

Responsive to the Office Action mailed August 9, 2002 (Paper No. 3), please amend the above-identified application as follows:

IN THE CLAIMS

Please amend claim 1 as follows:

1. (Amended) A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member which is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94 extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer being effective to afford said gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94 and penetrating into said fabric member to a depth which is less than the thickness dimension

A

PH-000458

of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

Please amend claim 3 as follows:

3. (Amended) The gasket of claim 1 wherein said flame retardant layer [of] is formed as a cured film of a flame retardant acrylic latex emulsion.

Please add the following new claims:

8. (Newly Added) A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer comprising between about 30-50% by weight of one or more flame retardant additives and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

9. (Newly Added) The gasket of claim 8 wherein said flame retardant layer has a thickness of between about 2-4 mils (0.05-0.10 mm).

10. (Newly Added) The gasket of claim 8 wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion.

PH-000459

11. (Newly Added) The gasket of claim 8 wherein said fabric member is a metal-plated cloth.

12. (Newly Added) The gasket of claim 11 wherein said cloth comprises fibers selected from the group consisting of cotton, wool, silk, cellulose, polyester, polyamide, nylon, and combinations thereof, and said metal is selected from the group consisting of copper, nickel, silver, nickel-plated-silver, aluminum, tin, and combinations thereof.

13. (Newly Added) The gasket of claim 8 wherein said foamed elastomeric material is selected from the group consisting of polyethylenes, polypropylenes, polypropylene-EPDM blends, butadienes, styrene-butadienes, nitriles, chlorosulfonates, neoprenes, urethanes, silicones, and polyolefin resin/monoolefin copolymer blends, and combinations thereof.

14. (Newly Added) The gasket of claim 8 wherein said fabric member has a thickness of between about 2-4 mils (0.05-0.10 mm).

15. (Newly Added) The gasket of claim 8 wherein said flame retardant layer is effective to afford the gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

16. (Newly Added) The gasket of claim 15 wherein said core member is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94.

17. (Newly Added) The gasket of claim 8 wherein said core member is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94.

18. (Newly Added) The gasket of claim 8 wherein said one or more flame retardant additives are selected from the group consisting of aluminum hydrate, antimony trioxide, phosphate esters, and halogenated compounds.

PH-000460

REMARKS

Reconsideration of the above-identified application as amended respectfully is solicited on behalf of the Applicants. With the instant response, two (2) claims are amended, and eleven (11) claims are newly added. A clean copy of the amended claims is annexed hereto. A supplemental information disclosure statement and a terminal disclaimer are filed herewith.

Claim 3 has been corrected to comply with 35 U.S.C. § 112, second paragraph.

Claims 1-7 have been rejected under 35 U.S.C. § 112, first paragraph.

As to claim 1, the claim has been amended in the interest of clarity to recite that "at least the exterior surface [of the fabric member is] electrically-conductive and the exterior surface defin[es] with the interior surface a thickness dimension of the fabric member therebetween," and further that the flame retardant layer "penetrat[es] into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive."

It is noted that claims 1-7 have been rejected for obviousness-type double patenting as being unpatentable over claims 1-8 of U.S. Patent No. 6,387,523. In order to materially advance the status of the present prosecution, a terminal disclaimer in compliance with 37 C.F.R. § 1.321(b) is filed herewith. The certification required under 37 C.F.R. § 3.73 accompanies the disclaimer.

As to claim 1 as amended, the claim now recites that the resilient core member is not V0-rated, and instead it is the flame retardant layer which is effective to afford the gasket a V0 rating. Similarly as to newly-added independent claim 8 recites that the flame retardant layer comprises between about 30-50% by weight of one or more flame retardant additives. In this regard, it is believed that the adhesive or other layers previously used in the art were not so highly loaded with flame retardant additives such that a gasket constructed therewith could achieve a UL rating of V0 notwithstanding that the other component parts thereof, namely the core, were not in and of themselves V0 rated. Rather, it is believed that conventional wisdom called for each of the components of the gasket to be V0-rated for achieving an overall gasket construction having a V0 rating. It remained for the instant Applicants, however, to recognize that a V0-rated gasket could be constructed without the core itself having to be V0-rated. Advantageously, Applicants' recognition allows for a flame retardant gasket to be produced having physical properties, such as high compressibility and resistance to compression set, which

PH-000461

approach those of standard gaskets. In contrast, the V0 gaskets which heretofore may have been known in the art are believed to have exhibited relatively poor physical properties as a result of the core having been highly loaded with the large amount of flame retardant additives necessary to effect a V0 rating for the core.

In view of the foregoing, wherein the claim program is believed to distinguish over the art made of record, the issuance of a Notice of Allowance is earnestly solicited.

Respectfully submitted,

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6035 Parkland Boulevard
Cleveland, OH 44124-4141
Voice: (216) 896-2212
Fax: (216) 896-4027
E-mail: jmolnar@parker.com

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited on November 13, 2002 with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231.

John A. Molnar, Jr.

PH-000462

Serial No. 10/142,803
Art Unit: 1762

AMENDED CLAIMS

Claim 1 has been amended as follows:

1. (Amended) A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member which is not V-0 rated under Underwriter's Laboratories (UL) Standard No. 94 extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer being effective to afford said gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94 and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

a2

Claim 3 has been amended as follows:

3. (Amended) The gasket of claim 1 wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion.

a3

PH-000463

EXHIBIT H

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

TV

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/883,785	06/18/01	BUNYAN M	2802-257-023

EXAMINER
CAMERON, E

ART UNIT	PAPER NUMBER
1762	3

DATE MAILED: 09/04/01

023984
JOHN A MOLNAR JR
PARKER-HANNIFIN CORPORATION
6035 PARKLAND BOULEVARD
CLEVELAND OH 44124-4141

IM52/0904

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

PTO-90C (Rev. 2/95)

PH-000594

PH-000594

Office Action Summary	Application No. 09/883,785	Applicant(s) BUNYAN ET AL.
	Examiner Erma C. Cameron	Art Unit 1762

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is FINAL. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-7 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-7 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a)☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
4)☐ Interview Summary (PTO-413) Paper No(s). _____.
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other:

U.S. Patent and Trademark Office
PTO-326 (Rev. 04-01) Office Action Summary Part of Paper No. 3

PH-000595

DETAILED ACTION

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a) Claim 3: layer of is ??

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-7 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a construction wherein the flame retardant coating does not penetrate to the full depth of the fabric member, so as to retain the electrical conductivity of the side not penetrated by flame retardant composition, does not reasonably provide enablement for any EMI shielding construction. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

See page 9, lines 12-28.

PH-000596

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erma C. Cameron whose telephone number is 703-308-2330. The examiner can normally be reached on 8:30-6:00, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on 703-308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-3599 for regular communications and 703-872-9475 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Erma Cameron

ERMA CAMERON
PRIMARY EXAMINER

Erma C. Cameron
Primary Examiner
Art Unit 1762

September 3, 2001

PH-000597

Notice of References Cited	Application/Control No. 09/883,785	Applicant(s)/Patent Under Reexamination BUNYAN ET AL	
	Examiner Erma C. Cameron	Art Unit 1762	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification	
	A	US-				
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
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	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification	
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Dye, James M. Compliance Engineering 17(3), pp 138 and 140-145, 2000
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PH-000598

EXHIBIT I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of Bunyan, *et al.*	)	Examiner E. Cameron
Serial No. 09/883,785	)	Group Art Unit: 1762
Filed: June 18, 2001	)	January 4, 2002
For: Flame Retardant EMI Shielding Gasket	)	Cleveland, Ohio 44124-4141

COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

AMENDMENT AND RESPONSE

Responsive to the Office Action mailed September 4, 2001, please amend the above-identified application as follows:

IN THE CLAIMS

Please amend claim 1 as follows:

A1

1. (Amended) A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer [being effective to afford said gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94] penetrating into said fabric member to a depth which is less than the thickness dimension of said

A

PH-000600

fabric member such that the exterior surface of said fabric member remains electrically-conductive.

Please amend claim 3 as follows:

3. (Amended) The gasket of claim 1 wherein said flame retardant layer [of] is formed as a cured film of a flame retardant acrylic latex emulsion

Please add the following new claim:

8. (Newly Added) The gasket of claim 1 wherein said flame retardant layer is effective to afford the gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

PH-000601

REMARKS

Reconsideration of the above-identified application as amended respectfully is solicited on behalf of the Applicants. With the instant response, two (2) claims are amended, and one (1) claim is newly added. A clean copy of the amended claims is annexed hereto.

Claims 1-7 have been rejected under 35 U.S.C. § 112, second paragraph.

As to claim 1, the claim has been amended in the interest of clarity to recite that "at least the exterior surface [of the fabric member is] electrically-conductive and the exterior surface defin[es] with the interior surface a thickness dimension of the fabric member therebetween," and further that the flame retardant layer "penetrat[es] into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive."

Regarding the newly-added claim 8, that claim further defines the gasket of claim 1 wherein the flame retardant member is "effective to afford said gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94." Such feature was previously recited in claim 1 as originally filed.

In view of the foregoing, wherein the claim program has been amended to clearly define the claimed invention as being novel and nonobvious over art made of record, the issuance of a Notice of Allowance is earnestly solicited.

Respectfully submitted,

John A. Molnar, Jr.
Reg. No. 36,611
PARKER-HANNIFIN CORPORATION
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Cleveland, OH 44124-4141
Voice: (216) 896-2212
Fax: (216) 896-4027
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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited on January 4, 2002 with the United Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231.

John A. Molnar, Jr.

A

PH-000602

Serial No. 09/883,785
Art Unit: 1762

AMENDED CLAIMS

Claim 1 has been amended as follows:

1. (Amended) A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

Claim 3 has been amended as follows:

3. (Amended) The gasket of claim 1 wherein said flame retardant layer is formed as a cured film of a flame retardant acrylic latex emulsion

PH-000603

EXHIBIT J

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	10/753,016
Applicant	:	Bunyan, *et al.*
Filed	:	January 7, 2004
Title	:	Flame Retardant EMI Shielding Gasket
TC/A.U.	:	
Examiner	:	
Docket No.	:	2802-257-023

Honorable Commissioner For Patents
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT UNDER 37 C.F.R. § 1.115

Pursuant to 37 C.F.R. § 1.115, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of the claims which begins on page 2 of this paper.

Remarks begin on page 4 of this paper.

PH-001165

This listing of claims will replace all prior versions, and listing, of claims in the application.

Listing of Claims:

Claim 1 (currently amended): A flame retardant, electromagnetic interference (EMI) shielding gasket comprising:

a resilient core member extending lengthwise along a central longitudinal axis and having an outer surface extending circumferentially about said longitudinal axis, said core member being formed of a foamed elastomeric material;

an electrically-conductive fabric member surrounding the outer surface of said core member, said fabric member having an interior surface disposed facing the outer surface of said core member and an oppositely-facing, exterior surface, at least the exterior surface being electrically-conductive and the exterior surface defining with the interior surface a thickness dimension of the fabric member therebetween; and

a flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer ~~being effective to afford said gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94~~ comprising at least about 50% by dry weight of one or more flame retardant additives and penetrating into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive.

Claim 2 (original): The gasket of claim 1 wherein said flame retardant layer has a thickness of between about 2-4 mils (0.05-0.10 mm).

Claim 3 (currently amended): The gasket of claim 1 wherein said flame retardant layer [of] is formed as a cured film of a flame retardant acrylic latex emulsion.

Claim 4 (original): The gasket of claim 1 wherein said fabric member is a metal-plated cloth.

PH-001166

Claim 5 (original): The gasket of claim 4 wherein said cloth comprises fibers selected from the group consisting of cotton, wool, silk, cellulose, polyester, polyamide, nylon, and combinations thereof, and said metal is selected from the group consisting of copper, nickel, silver, nickel-plated-silver, aluminum, tin, and combinations thereof.

Claim 6 (original): The gasket of claim 1 wherein said foamed elastomeric material is selected from the group consisting of polyethylenes, polypropylenes, polypropylene-EPDM blends, butadienes, styrene-butadienes, nitriles, chlorosulfonates, neoprenes, urethanes, silicones, and polyolefin resin/monoolefin copolymer blends, and combinations thereof.

Claim 7 (original): The gasket of claim 1 wherein said fabric member has a thickness of between about 2-4 mils (0.05-0.10 mm).

Claim 8 (new): The gasket of claim 1 wherein said flame retardant layer is effective to afford the gasket a flame class rating of V-0 under Underwriter's Laboratories (UL) Standard No. 94.

Claim 9 (new): The gasket of claim 1 wherein said one or more flame retardant additives are selected from the group consisting of aluminum hydrate, antimony trioxide, phosphate esters, and halogenated compounds.

Claim 10 (new): The gasket of claim 1 wherein said flame retardant layer comprises between about 50-83% by dry weight of one or said one or more flame retardant additives.

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REMARKS

Consideration of the above-identified application as amended respectfully is solicited on behalf of the Applicants. With the instant response, 2 claims have been amended and 3 claims have been newly added.

A terminal disclaimer is filed herewith in compliance with 37 C.F.R. § 1.321(b) is filed herewith. The certification required under 37 C.F.R. § 3.73 accompanies the disclaimer.

Claim 1 has been amended in the interest of clarity to recite that "at least the exterior surface [of the fabric member is] electrically-conductive and the exterior surface defin[es] with the interior surface a thickness dimension of the fabric member therebetween," and further that the flame retardant layer "penetrat[es] into said fabric member to a depth which is less than the thickness dimension of said fabric member such that the exterior surface of said fabric member remains electrically-conductive."

Claim 1 also has been amended to recite that the flame retardant layer coating at least a portion of the interior surface of said fabric member, said flame retardant layer comprises at least about 50% by dry weight of one or more flame retardant additives. Support for the amendment may be found at page 10, lines 7-15 of the instant specification as filed, and further in the Example at page 14, lines 23-24.

In this regard, the specification describes the 30-50% range is based on the total weight of the emulsion. With the emulsion having a total solids content of about 60%, such 30-50% range therefore corresponds to a dry weight basis in the dried or otherwise cured film of the layer [*See* Specification, at page 14, lines 4-8], of between about 50-83%. For example, at 60% total solids, 100 parts by total weight of the emulsion contains 30-50 parts of the one or more flame retardant additives, and 60 parts by weight solids. On a solid or dry basis, *i.e.*, with the 40 parts water having been removed, the total weight of the layer is now 60 parts with between about 30-50 parts thereof, *i.e.*, about 50-83%, being the additive composition or concentration.

Claim 3 has been amended to correct an informality.

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As the present claim program is believed to properly distinguish over the art of record, an early notice of allowance respectfully is solicited.

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited on March 10, 2004, with the United Postal Service as first class mail in an envelope addressed to: Mail Stop Non-Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

John A. Molnar, Jr.

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